



# EXPERIMENT STATION RECORD.

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## EXPERIMENT STATION RECORD.

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In the midst of the storm and stress of war active attention is already being given in Europe to the subject of reconstruction after its close. It is natural that agriculture should figure prominently in these plans, for the events of the past three years have given it a new place in the life of nations and have brought a new realization of its relationship to national welfare and security. The necessity for a definite national policy which will stimulate and promote that industry has been impressed upon the public mind in those countries as never before.

Furthermore, the unusual steps which have been taken toward production as a war measure have prepared the way for future changes of a radical character. The precedents of hundreds of years have been swept aside almost over night. There has been a remarkable and convincing demonstration of the effects of past neglect, and the idea of the interest of the whole people in the use made of the land as a national asset has developed out of stern experience and found speedy recognition.

British statesmen have declared that no government would again neglect agriculture as it had been neglected in the past; and the change of attitude has been well put by the secretary of the Board of Agriculture for Scotland, who said: "In short, a new outlook has been compelled by the war. The essential value of agriculture and forestry to the country is at last realized. The national danger involved in their neglect is at last appreciated; their complementary character is at last understood."

In a book entitled *Agriculture after the War*, published about a year ago, Mr. A. D. Hall, former director of the Rothamsted Station, frankly expressed the need for the adoption by the State of a considered agricultural policy for the better utilization of the land. His text was the need for an increased production of food at home, and the greater employment of men upon the land as essential to the security of the nation as a whole. This need was made independent of the particular interests of either landowners or farmers, and embodied the rather novel conception that a man owes responsibility to the community for the way he conducts his business in farming.

More recently another book has appeared, entitled *British Agriculture—the Nation's Opportunity*, which is based on the minority report of a committee appointed by the British Board of Agriculture, on the employment on the land of discharged soldiers and sailors. The book contains an introduction by Mr. A. D. Hall, who explains that it is the first effort appearing under public authority to set out a program for the reconstruction of rural life. It represents a considerable revolution in public opinion with regard to the position of agriculture in the United Kingdom, obscurely progressing for many years but suddenly strengthened and crystallized by the war, until "there are few people who now have not been taught by events that agriculture must be revived in the national interest." The uncertainty of disturbed economic and industrial conditions after the war directs attention, as he says, to the land as the great undeveloped asset of the nation, the prime source of wealth and the first link in the whole chain of industries.

Granting the case for the reconstruction of agriculture, the elements of the process are described as threefold—the establishment of such a level of prices as will render intensive farming possible, the improvement of the position of the laborer, as regards wages, housing, and the amenities of life, and, lastly, the recognition that ownership of land carries with it a duty to the community.

The British Government has had for some time in operation a Ministry of Reconstruction, with a large number of commissions and committees—some eighty-seven in all—to deal with questions which will arise at the close of the war. Under the section of agriculture and forestry, four committees are included, namely, on agricultural policy, forestry, land settlement, and horse breeding. There are also committees on cold-storage research and on food research, to deal respectively with the problems of the preservation of food, and with the cooking of vegetables and meat, and bread making. For the cotton industry, there are committees on cotton growing within the Empire, Indian cotton, and research and education for the cotton industry, with a view to the organization of a research association. These committees have been in active operation for some little time, and a number of them have already made preliminary or partial reports.

A committee of special interest is that on agricultural policy, appointed by the Prime Minister in August, 1916, and headed by the then president of the Board of Agriculture. The committee includes among others, such well-known men as Mr. A. D. Hall, Mr. R. E. Prothero, the present president of the Board of Agriculture, and Sir Horace Plunkett. It was charged with considering and reporting upon the methods of effecting needed increase in home-grown

food supplies, having regard to the need for such increase in the interest of national security. It has rendered a partial report which illustrates how deeply Great Britain has been stirred in this matter and how decidedly the events of the war have altered the attitude toward the agricultural industry.

In spite of the depleted condition of agriculture at the outset of the war and the continued dependence of the country on imported food, the conviction is expressed that a large proportion of the imported food of Great Britain which is capable of being grown there could be produced in the islands, if a complete policy for the State were adopted and consistently carried out. The report declares that "the State must adopt such a policy and formulate it publicly as a future basis of British agriculture, and explain to the Nation that it is founded on the highest considerations of the common weal."

The war has shown, as the report states, that methods and results of land management and of farming are matters involving the safety of the State, and are not merely the concern of individual interests. "The agricultural land of the country must gradually be made to yield its maximum production," and this implies a large change from permanent grass to arable cultivation. While many factors are recognized as being involved in a scheme of agricultural policy, a basis of security and stability of the conditions under which agriculture is to be carried on in the future is placed at the foundation of the whole structure.

"The conditions of agriculture must be made so stable that out of its profits the agricultural laborers can be assured a fair wage, the cultivator of the soil a fair return for his capital, energy, and brains, and the landowner a fair return for the capital invested in the land." To accomplish this end, it is recommended that the State should fix minimum wages for the ordinary agricultural labor, determined by wage boards, and guarantee to the farmer a minimum price for wheat and oats. Furthermore, if it should be found advisable to adopt a tariff on manufactured goods, it is urged that one should be imposed on imported foodstuffs, such as dairy produce, meat, and "corn," and special consideration shown to products of the more intensive forms of agriculture involving large invested capital and unusual expense for labor and cultivation. Unless the farmer is assured against a recurrence of the prices of 1894-95, it is anticipated that the process of seeding down arable land to grass will recommence immediately after the war, notwithstanding high prices.

As to the method of securing efficient production, the report recommends a general survey of the conditions of agriculture throughout the United Kingdom, conducted by the boards and departments of agriculture, with provision for eventually bringing about the proper use of land which is found not to be utilized to its full extent

for the production of foodstuffs or timber. This provision might even involve the temporary taking over of an estate or parts of it where necessary, to be managed by the Board of Agriculture until the desired improvement had been accomplished. "It must be clearly understood," the report states, "that henceforth bad farming is a danger to the State, and that the waste of good land on game or games is inconsistent with patriotism. . . . Estates must be managed with a single eye to maximum production," and capital must be attracted to the industrial equipment and improvement of the land and to the operations of intensive farming.

It is interesting to note as one of the fundamental requirements in carrying out such a scheme for enlarged production that it is considered essential that the country "be permeated with a complete system of agricultural education." In addition to providing security against loss, it is realized that farmers must have placed at their disposal the best available scientific and practical advice. "Indeed, it will be impossible to carry out the scheme (except with serious loss and wastage) unless it is accompanied by an important development of the facilities at present available in the United Kingdom for agricultural education, technical advice, and research." This, it is explained, would also include demonstrations of improved methods and their financial soundness.

These latter subjects, although mentioned, are considered of such importance that their consideration is deferred to a subsequent part of the report. The discussion of them will be awaited with much interest. Many articles in the British press and reports on other branches of reconstruction give evidence of increased appreciation of science and technical education, which it is expected will find expression in the plans now being formulated. For it is now too manifest to require argument that agricultural progress and sound agricultural teaching and practice must rest on agricultural inquiry and its application.

A minority report, while taking exception to some of the proposals advanced by the majority, lays special stress on agricultural education and demonstration. Efficiency is the keynote of the situation, the writer says; "give the farmer information, acquaint him with the reason of things, and you will give him the most wholesome kind of State aid." He advocates placing technical instruction and agricultural education under the jurisdiction of the departments of agriculture; "a million pounds, or a much larger sum if necessary, annually spent in this way would repay the expenditure tenfold." Instruction is advocated which is brought down to the farmer and enlists his interest. "Demonstrate to him on his own land, even keep his books for him for a time if necessary, but leave him with no excuse for ignorance."

Expressions like this have a familiar sound in this country, for they reflect the spirit and the conviction upon which our system of State and Federal aid has been built up.

In spite of the terrible ordeal through which France is passing, reconstruction work is already under way and plans are actively being made for future activity at the close of the war. These plans as related to agriculture look toward the amelioration of the condition of the farmers, the regeneration of agricultural communities, and a more highly intelligent use of the land as a result of enlarged means for acquiring and spreading agricultural knowledge. These movements speak eloquently of the enterprise, the foresight, and the undaunted courage of the French people.

The work of reconstructing the devastated parts of France has been proceeding actively for over a year under the leadership of the head of the Office of Agricultural Reconstruction. The industry has been aided by provision for the purchase and resale or allotment of seed, fertilizers, nursery stock, cattle, etc., by the introduction of farm motors for plowing and cultivating, and in many other effective ways. Through the French Ministry of Agriculture and the agricultural cooperative societies, unusual credit facilities have been provided farmers for rebuilding, restocking, and restoring their farms to productive condition. Much interest attaches to the published articles in the press and scientific journals from leaders in agricultural thought in that country, in relation to the measures for rehabilitating agriculture after the war. Among the plans to that end, increased facilities for agricultural research have figured prominently.

Reference was made in a previous issue to the report of a commission of the French Academy of Science, which laid stress on the necessity for reorganizing the whole system of research, instruction, and assistance in agriculture in that country. Since then other papers dealing with the subject have appeared under different auspices, showing how widespread is interest in the subject, and testifying to the confidence which is felt in the effectiveness of research as a means of advancement. Reference may be made to two of these papers by men whose names are familiar to us in this country.

In a communication to the Academy of Agriculture of France, Prof. Edmund Gain, director of the Institute of Agriculture at the University of Nancy, discusses the means for increasing agricultural production and outlines a plan for the reorganization of a series of agricultural stations in the various districts on a somewhat novel plan. He regards the reestablishment of the agricultural industries on a firm basis after the war as the only way in which the country



can recover itself. The average production of such staple crops as wheat, oats, and potatoes, is shown to be much less than that in neighboring countries, the remedy for which lies in selection of suitable varieties and their improvement, the efficient use of fertilizers, and cultivation. To accomplish these requires a sufficient fund of reliable knowledge on the part of the farmer, proper equipment in tools and machinery, and adequate capital, and it is along these three lines that it is proposed to develop stations to aid the farmers.

The proposed organization divides the work of the stations into two main divisions, namely, the scientific division for conducting experiments and researches in the whole range of agricultural science, and the exercise of control over fertilizers, feeds, etc.; and the division of rural economy, to include a bureau of information, rural instruction, marketing, agricultural labor, the cooperative purchase of machinery, maintenance of demonstration farms, and a section for farm credit. The latter would be provided with funds through the aid of large landed proprietors of the district, which would be loaned to the farmers in small amounts on the security of their growing crops.

Ten stations organized on the above basis are proposed, each with a government grant of \$30,000, to be supplemented by funds subscribed or loaned by local capitalists and landowners. The plan is comprehensive, and except for the loan feature is not very different from a union of our own station and extension departments.

At a conference presided over by the French Minister of Agriculture, M. Georges Wery, vice director of the National Institute of Agronomy at Paris, presented an able paper on agricultural research institutions in France and other countries, with plans for the reorganization of the French stations. He justly pays a high tribute to the product of agricultural research in France in the past, but explains that of late the experiment stations have become absorbed to increasing degree in analytical and control work, to a point which is seriously affecting their activity as research institutions.

The present system for the support of the stations favors the growth of analytical work, the officers receiving a portion of the fees as supplements to their salaries, and the department in which the station is located profiting by this source of revenue. The growth of this line of activity has, as M. Wery states, diverted the stations from their original purpose of agricultural research, for the number of workers being small the time left for investigation is greatly reduced. He argues for a separation of the control and regulatory functions of the stations from their research, and a larger and more adequate budget, pointing to the experience of other countries in this respect and to the generous support of experiment stations in the United States and Germany particularly.

Another weakness cited in the present organization of the French stations is their local character, the tendency being to work on questions of quite local interest rather than on broad agricultural problems, and their lack of organization into a coherent system. Certain of the stations have originated with the Ministry of Agriculture, others have sprung from the Ministry of Public Instruction, and still others from the various departments of the country. Moreover, the stations taken as a whole are restricted in the scope of their activities, leaving several important branches of agriculture dependent for progress upon the research of other countries. "We still cling to the original conception which gave rise to the first laboratories, i. e., the study of soils and fertilizers. We do not seem to have followed the evolution of scientific agriculture. We seem to neglect the more difficult problems of biology which offer such large promise."

The system of experiment stations for which M. Wery argues is a well-knit system, drawn together by organization and mutual interest, supported jointly by the State and the locality, connected mainly with the agricultural schools and institutes, and developed along the lines of the principal needs for investigation in the districts in which they are located. They would include specialists in the important branches of agriculture, with the control work organized so as not to conflict with the investigation. He believes such a system would be preferable to the large number of laboratories inadequately manned and supported.

The rôle which the State should play in respect to these agricultural research institutions is strongly emphasized, for they are declared to exercise a fundamental relation to the development of a principal source of national wealth and security upon which in time of war the very life of the nation may depend.

The contention that the stations should be connected with institutions of learning is thoroughly sound. This not only places them in the proper atmosphere, develops the spirit of research, and encourages the coordination of the groups of specialists, but, as M. Wery points out, it establishes the proper relationship between research and the higher grades of instruction, directs young men to the field of agricultural investigation and encourages them to prepare for it, and it extends the range of usefulness and influence of the schools themselves, giving them standing in the scientific world as well as in the industry.

The advantage of this association of the stations with colleges or schools has been illustrated wherever followed, but nowhere more forcefully or convincingly than in this country. Here the benefits have been so manifest with increasing time as to remove any doubt of the wisdom which led to the provision, at a period when there was much precedent and argument for separate stations. While the real

advantages came somewhat slowly, they long ago fully justified the restriction carried in the original measure.

Both of these papers, and others which have gone before, pay high tribute to the American stations. Not only is the example cited of their liberal support, but many approved features of their organization and profitable results of their activity are pointed out. M. Gain pronounces the funds assigned to them among the most productive of Government expenditures. M. Wery commends them in terms which are highly complimentary, both for the efficiency of their organization and their comprehensive scope, including, as he says, nearly five hundred distinct laboratories, each working in a particular line but all converging to the same end, the progress of agriculture in its various branches. He contrasts their large revenues with those of the stations and laboratories in his country, citing this as an example of wise and profitable use of governmental funds.

Gratifying as this is, the large financial support which is always cited to the advantage of the American stations carries with it large expectations as to the returns to be made for these ample means and opportunities. These world expectations can not be met unless the personnel is maintained upon a high plane of efficiency and the funds are carefully conserved for investigation and experiment. Even then the broad extent of country to be covered, the great diversity of questions, some of them quite elementary as a result of the settlement of new country, and the necessarily expensive character of investigation in certain lines, are likely to be unappreciated.

While therefore European countries are planning for reconstruction to include the development of their agricultural research institutions, the American experiment stations may well consider how their work and organization may be made more productive and effective in meeting after-war conditions, in full accord with the abundance of their opportunity.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

The relation of some of the rarer elements in soils and plants, W. O. ROBINSON, L. A. STEINKOENIG, and C. F. MILLER (*U. S. Dept. Agr. Bul. 600 (1917)*, pp. 25, figs. 3).—An earlier publication (*E. S. R.*, 31, p. 719) included a chemical analysis of certain important American soil types for the presence of the rarer elements. The purpose of the present bulletin was to determine the content of the rarer elements present in plants grown in soil of known composition and to establish the relationship between soil and plant composition. References to previous work along the same line are included.

So far as possible, the plants selected had grown on soils previously analyzed and differing widely in composition. Legumes, vegetables, grasses, trees, and shrubs were included in the investigations. The methods of analysis are given in detail and the results tabulated. In order to keep the temperature fairly uniform during the ashing an electric furnace with a temperature regulator was designed. The essential part of the automatic control was a couple consisting of a quartz tube closed at one end, inside of which was placed a nickel rod. Diagrams and a description of the furnace and regulating devices are given.

Of the rarer elements, lithium was found in all the plants examined, rubidium in the majority of cases, caesium in the ash of timothy, raspberry, and beets grown in localities where the soil is known to contain caesium beryls. Chromium was found occasionally but in small amounts, vanadium in only a few cases, and molybdenum not at all. Barium was present in all plants and strontium in all except bean seeds. Titanium was found in very small amounts in all plants, and aluminum in all but two, pine needles being very rich in this element.

It was found that manganese in plants varied in amount more than most of the other elements and that a large amount of rare alkalis was generally accompanied by an abnormal amount of manganese. There were wide variations in the composition of the same kind of plant, but it is the opinion of the authors that "the most profound influence the composition of the soil has on the plant is not on the composition of the plant but on the occurrence of that plant on the soil."

With the possible exception of sulphur, chlorine, and manganese, there was no indication that the elements determined, except those commonly used, need be considered in fertilizers.

The influence of carbon monoxid on the velocity of catalytic hydrogenation, E. B. MAXTED (*Trans. Faraday Soc.*, 13 (1917), No. 1-2, pp. 36-42, figs. 4; *Ann. News*, 117 (1918), No. 3038, pp. 73-75, figs. 4).—This article reports the results of investigations on the effect of carbon monoxid on the velocity of catalytic hydrogenation. The subject is of importance on account of the presence of a small amount of carbon monoxid in hydrogen prepared commercially from water gas. Carefully neutralized olive oil was hydrogenated with mixtures of the purest electrolytic hydrogen and varying amounts of carbon

monoxid in the presence of finely divided nickel. The apparatus used has been found by the author to be very useful for the quantitative study of catalytic hydrogenation, and is described in detail.

It was found that carbon monoxid exerted a very marked poisonous effect other than the purely obstructive or diluting action of any foreign gas. The first traces of carbon monoxid had relatively the greatest retarding influence on the velocity of hydrogenation.

**The fats and fatty acids of the grain sorghums.** C. K. FRANCIS and W. G. FRIEDEMANN (*Oklahoma Sta. Bul.* 117 (1917), pp. 3-14, fig. 1).—Continuing the study of grain sorghums previously noted (*E. S. R.*, 35, p. 108), this bulletin records a detailed chemical analysis of the fats and fatty acids of the sorghums, Kafir corn, feterita, and milo maize. The experimental methods, where differing from those of the Association of Official Agricultural Chemists, are given in detail.

As large quantities of the crude fat were necessary for investigation, special apparatus was designed to permit a large amount of the raw material to be treated at one time. Four kg. of finely ground grain was put in an 8-liter aspirator bottle and covered with 1,000 cc. of ether. The bottle was shaken at intervals for 24 hours, then inverted, and the ether removed by percolation. The process was repeated seven or eight times until the extract was colorless. The percentage of fat obtained agreed closely with that obtained by the official (indirect) method.

The fat extracted from milo maize is a liquid at ordinary temperatures, containing a small amount of solid fat; that of Kafir corn and feterita a greenish vaseline-like substance. The physical and chemical constants of the fat from the three varieties showed a marked similarity.

The analysis showed six fatty acids to be present in similar proportions in the three sorghums. The volatile acids varied from 0.59 to 0.85 per cent of the fats. Formic and butyric acids were found in all three and some of the higher volatile acids in Kafir corn fat. From 7 to 10 per cent of the fat consisted of a mixture of palmitic and stearic acids, with traces of higher saturated acids in Kafir corn and milo maize fat. Stearic acid predominated in Kafir corn and feterita fat, and palmitic in milo maize fat. From 80 to 86 per cent of the fat consisted of the unsaturated acids, oleic and linoleic.

The analysis offers additional evidence of the close relationship of the plants under investigation.

**The seeds of the *Echinocystis oregana*.** M. R. DAUGHTERS (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 2, pp. 126, 127).—This article reports the results of studies to determine the possible industrial value of the seeds of *E. oregana*, or wild cucumber, which grows very abundantly along the Pacific slope from British Columbia to California. Tables are given of the percentage composition of the seeds and the constants of the oil obtained by extraction with petroleum ether and by expression in the cold from the ground whole seed.

The constants of the oil indicated that it belongs to the cottonseed group. The taste is similar to olive oil. When subjected to hydrogenation, a bland yellowish-white fat was produced, with a melting point of 29 to 36° C., a solidifying temperature of 25°, and an iodine number of 76.8. Feeding experiments with mice showed both the original oil and the hydrogenated fat to be non-poisonous.

**Analytical examination of acorns and horse chestnuts.** J. L. BAKER and H. F. E. HUTTON (*Analyst*, 42 (1917), No. 500, pp. 351-355).—Analyses of four samples of horse chestnuts and two of acorns, with particular reference to carbohydrate content, are reported.

It was found that the chestnuts possess considerable diastatic activity. An examination of the diastase showed that it resembled that of an ungerminated cereal in its action. No evidence of a similar diastase in acorns could be obtained.

The possible utilization of chestnuts and acorns as a source of alcohol was studied. The ground nuts were boiled with 2 per cent sulphuric acid under a reflux condenser for three hours, filtered, and the filtrate neutralized. The solution of sugar was then fermented for three or four days with brewer's yeast. A yield of alcohol of 27 and 27.3 per cent for the dry peeled kernel and 11.6 and 11.5 per cent for nuts as picked was obtained from two samples of chestnuts. The corresponding yields for two samples of acorns were 26.1 and 27.5 per cent for dry-peeled kernel and 12 and 12.7 per cent for nuts as picked. This is equivalent to a yield of from 32 to 36 gal. of absolute alcohol per ton of the nuts as picked.

Division of chemistry, annual report, 1915-16, B. DE C. MARCHAND (*Union of Africa Dept. Agr. Rpt. 1916, pp. 105-108*).—This includes analyses of soils, manures and other fertilizers, feeding stuffs, and brine salts.

A simple and efficient filtering tube, W. M. THORNTON, JR. (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 2, p. 132, fig. 1).—The author describes a simple device for filtering with the least possible volume of the liquid used for transferring and washing the precipitate. Filtration may be very quickly performed, thus reducing the losses incurred in handling precipitates which increase in solubility on rise of temperature.

The utilization of the adsorptive power of fuller's earth for chemical separations, A. SEIDELL (*Jour. Amer. Chem. Soc.*, 40 (1918), No. 1, pp. 312-328, figs. 2).—In view of the practical application of the utilization of fuller's earth in the separation of alkaloids from plants and "vitamins" from mixtures in which they occur (E. S. R., 35, p. 472), the author has conducted a series of investigations on the adsorptive power of fuller's earth from different sources and the effects on the adsorptive process of such factors as time, agitation, dilution, presence of other dissolved substances, etc. Methods of procedure and analytical data in the form of tables and charts are given. The materials used for adsorption were quinin bisulphate and methylene blue.

A comparison of the adsorptive capacities of 36 samples of fuller's earths and other clays showed that English earth is superior to any of the domestic fuller's earths except one, the exact source of which could not be learned. Bentonite, which has a greater adsorptive power than the English fuller's earths, can not be used to advantage on account of its unusual capacity for retaining water. From the experimental data the author concludes that "the adsorptive power of fuller's earth is exerted particularly toward certain compounds characterized by distinct basicity, and that in the case of salts only the base unites with the fuller's earth. No marked selectivity was found in the case of the two compounds forming the basis of the present experiments. The amount adsorbed in a given time is a function of ratio of earth to adsorbable material and, except with insufficient earth for complete adsorption, is independent of dilution, acidity, or presence of nonadsorbable neutral material."

Treatment of corks used in Soxhlet and other extraction apparatus, T. J. WARD (*Analyst*, 42 (1917), No. 499, pp. 326, 327).—A method is described for treating corks to be used in Soxhlet and other extraction apparatus to overcome errors arising from the porosity of cork and the solubility of certain constituents of the cork in the extraction solvent. The corks are heated for two hours on a boiling water bath in a solution of gelatin (previously soaked in cold water for five or six hours and then melted) in one-quarter volume of

glycerol and two volumes of water. They are then removed, dried, and used in a Soxhlet apparatus for an hour. Thus treated they may be used to advantage with any solvent in the vapor of which water and glycerol are not readily soluble. They should be stored at ordinary temperature, as a warm dry atmosphere causes them to shrink and harden.

The preparation of 1/100-normal permanganate solutions, J. O. HALVERSON and O. BERGEM (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 2, pp. 119, 120).—New technique for the preparation of  $\frac{1}{100}$ -normal solutions of potassium permanganate is described and a table given of the keeping qualities of dilute permanganates and of oxalic acid solutions used as standards.

A proximate quantitative method for the determination of rubidium and cesium in plant ash, W. O. ROBINSON (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 50, 51).—This method is based on the removal of a large part of the potassium chlorid by fractional precipitation with platinic chlorid and, further, by strong hydrochloric acid. The resulting solution is compared spectroscopically with a standard solution.

The method is as follows: Twenty or more gm. of the dry plant are ashed in a muffle below 525° C. The ash is dissolved in hydrochloric acid, the excess evaporated, freshly slaked lime added, and the mixture boiled and filtered. The calcium is precipitated with ammonia and ammonium carbonate, the combined filtrates evaporated to dryness, and ammonium salts expelled. The alkali chlorids are filtered off with hot water, a few drops of hydrochloric acid added, and then about 0.05 gm. of platinic chlorid. The solution is evaporated to pastiness, a small amount of hot water added to dissolve the unchanged chlorids of potassium and sodium, and the chloroplatinates of the rare metals are washed on to the asbestos pad in a small carbon filter with 80 per cent alcohol. The filter is then connected to a hydrogen generator and the platine chlorids reduced by heating with a Bunsen burner. The chlorids are washed through the filter with hot water, the filtrate evaporated to pastiness, and the mass taken up by a few drops of hydrochloric acid, filtered into tiny vials, and made up to volume. Standards are made with known amounts of cesium and rubidium chlorids and an excess of potassium chlorid. The comparison is made by introducing a coil of platinum wire of sufficient size to withdraw a large drop. The coil is carefully dried and the unknown solution matched with a standard by means of the brilliancy of the hue.

Method for the determination of the amount of sugar in baked articles (*Analyst*, 42 (1917), No. 498, pp. 294, 295).—This is the official method proposed by the Government Laboratory (England) for the determination of the amount of sugar present in baked articles examined under the Cake and Pastry Order. The preparation of samples and the methods of analysis are given in detail. If necessary to use a clearing agent, basic lead acetate followed by sodium sulphate, or alumina cream, or copper sulphate solution may be employed. The sugar is inverted with hydrochloric acid and the reducing sugar determined either by gravimetric or volumetric process and calculated as cane sugar. If the article contains fruit, the fruit is removed and analyzed separately for its sugar content.

A deduction of 3 per cent is made for sugars naturally present in flour or derived from flour in the course of baking, and an allowance of 2 per cent is made to provide for variations in sampling, in methods of analysis, and in the amount of sugar in the different materials employed.

Detection of alum in flour, L. MEDRI (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 11, pp. 597-601).—A delicate method for detecting alum in flour is described. The principle involved is the formation of an insoluble color lake with cochineal.

alizarin. To 50 cc. water extract of the flour, 2 cc. of an alcoholic solution of the dye is added, and the solution heated to boiling. If the flour is pure, a white or cream-colored coagulum is formed from the soluble protein. The presence of alum causes the formation of the color lake characteristic of the dye used.

Tables are given showing the characteristic colors with cochineal and alizarin in the presence of different percentages of alum and also of zinc, copper, and lead.

Research on the detection of added water in milk, H. DURAND and R. STREVENSON (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 26-30, fig. 1).—This is a report of new methods for the detection of added water in milk proposed in an earlier article (E. S. R., 36, p. 807). The first two methods were based on the theory that water would increase the solubility of organic salts in the serum of milk. In one case lead subacetate was used and in the second silver nitrate. Both methods proved unreliable. The third method, the determination by the electrical conductivity method of Kohlrausch of the whole milk and of the serum after coagulation with electrolytes and nonelectrolytes, was carried out in an elaborate series of experiments but with no uniformity of results. One of the authors proposes to continue the research, making use of the osmotic pressure of milk in a cell constructed to measure the differential osmotic pressure between milk and a standard saline solution.

The differentiation of coconut oil and palm-kernel oil in mixtures, G. D. ELISON (*Analyst*, 42 (1917), No. 498, pp. 298-300).—The author states that it is possible to distinguish between coconut and palm-kernel oils in mixtures of various fats, such as margarin, by obtaining both the Polenske and Shrewsbury-Knapp values and assuming the presence of palm-kernel oil in those cases in which the percentage of coconut oil calculated from the Polenske figure is less than that from the Shrewsbury-Knapp figure. This may, however, indicate the presence of coconut stearin which has practically the same composition as palm-kernel oil. He emphasizes the importance of the Shrewsbury-Knapp process in preventing incorrect conclusions being drawn from the Polenske process.

A combined Reichert-Polenske and modified Shrewsbury-Knapp process, G. D. ELISON (*Analyst*, 42 (1917), No. 498, pp. 295-298, fig. 1).—This article gives the results of a combination of the modified Shrewsbury-Knapp process previously noted (E. S. R., 37, p. 618) with the Reichert-Polenske process for the estimation of coconut oil in mixtures. The process is carried out as follows:

The flask containing the residual acids after the distillation of 110 cc. in the Reichert-Polenske method is cooled in water until the acids have become a solid cake. The cake is broken and the liquid strained through a fine wire sieve. The fatty acids are washed with 50 cc. of cold water, drained, returned to the flask and dried in the oven. One hundred cc. of alcohol (sp. gr. 0.9200 at 20° F.) is then added and the process continued as given in the previous paper.

The method is much more rapid than the Shrewsbury-Knapp process. The results of analyses of various mixtures of coconut oil with butter and with margarin are given in tabular form and also in the form of curves from which the percentage of coconut oil in a given mixture may be read off. In using this combined process on butters, high figures for alcohol-soluble acids are invariably found in conjunction with high Reichert values. Consequently a high alcohol-soluble acid figure with a low Reichert value would indicate the presence of coconut oil while neither the Reichert nor the Polenske number alone would raise suspicion.

Variation in the ether extract of silage, L. D. HAIGH (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 2, p. 127).—Analyses are reported showing the



variation in the composition of the ether extract of silage, depending upon changes in the sample itself on standing and upon the drying operations employed. Further studies are being made to ascertain the causes of such variation.

A constant temperature and humidity room for the testing of paper, textiles, etc., F. P. VEITCH and E. O. REED (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 38-44, figs. 6).—This article describes the specially constructed and automatically controlled constant-temperature and humidity room at the Bureau of Chemistry, U. S. Department of Agriculture. The room is used in the testing of paper, but it is pointed out that the control of humidity is of importance in many industrial lines, and is being applied to the ripening of fruit, curing of cheese, drying of lumber, etc.

A method for determining the absorbency of paper, E. O. REED (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 44-47).

The cost of producing maple products in 1912 and 1913, C. J. FRANK (*Vermont Sta. Bul.* 203 (1917), pp. 17-24, figs. 3).—The author has collected from a number of sugar producers in Vermont data concerning the cost of production of maple products and prices received for the same during the seasons of 1912 and 1913 and has arranged the data in the form of tables and graphs.

The relation between total cost per pound and production per bucket is considered significant. A decrease in the cost per pound coincides with increased yield per bucket. The graph of this relationship gives a general idea of the probable cost of a pound of sugar for any given average bucket production. A 1-lb. per bucket yield showed a manufacturing cost of 11 cts. for 1 lb. of sugar while a 3-lb. per bucket yield reduced the cost to 7.5 cts. per pound.

Vinegar from waste fruits, W. V. CRUESS (*California Sta. Bul.* 287 (1917), pp. 169-184, figs. 11).—This bulletin describes the necessary apparatus and procedures for the alcoholic fermentation, acetic acid fermentation, and clarification and filtration of the product in the conversion of waste fruit juices into vinegar. Brief notes on vinegar diseases are included.

The canning industry.—Some accomplishments and opportunities along technical lines, H. A. BAKER (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 69-71).—This includes a brief history of the canning industry in the United States, an outline of some of the problems confronting the industry and their solution, and suggestions as to further possibilities of conservation by the discovery of methods of utilizing waste products. The importance of chemists in the industry is emphasized.

### METEOROLOGY.

Climatic control of cropping systems and farm operations, J. F. VOORHIES (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 127-132).—The author maintains on the basis of his study of conditions in Tennessee that all successful cropping systems must be so planned that they make use of all favorable climatic conditions. "To do this to the best advantage the time required for each crop to mature under any given conditions must be known. The effect of variations in heat intensity upon the various stages of the life history of insect pests should also be known." The discussion is confined "to the broad and comparatively unchanging features of climate and disregards the more changeable features of weather . . . [such as] the average conditions of temperature, rainfall, and growing season at a given place for a long period of years." These are considered with reference to continuous cropping, two-crop, and one-crop systems of farming.

A marked correlation between intensity of temperature and time required for crops to mature was shown in studies carried on by the author in cooperation

tion with the Tennessee Experiment Station and certain stations of the Weather Bureau of the U. S. Department of Agriculture with soy beans and corn extending over eight years and covering "a territory extending from the Gulf to the Great Lakes and from the Atlantic to the Rocky Mountains. Records were kept of dates of planting, emergence, blooming, and ripening, together with the daily maximum and minimum temperatures and rainfall.

"It was found that between plantings made at the same date, but at places having different temperature conditions, there was a wide difference in the length of time required for the different stages of growth. A similar difference was found between plantings made at different dates at the same place. These variations were always in the same direction, but different in amount. It appeared that the higher the mean temperature the shorter the time required for the plant to reach a certain stage."

With the Mammoth Yellow soy bean, for example, the period from planting to blooming was found to vary from 42 to 133 days. The correlation between mean temperature and length of time from planting to blooming with 50 plants of this variety was  $-0.76$  with a probable error of  $\pm 0.05$ . The correlation "between mean temperature and the length of the period from emergence to blooming of Indian corn at Wauseon, Ohio, gives a coefficient of  $-0.79$ ,  $\pm 0.06$ ."

A similar study of the correlation of heat intensity and the length of the incubation period of the cattle tick (*Margaropus annulatus*) at Dallas, Tex., gave a coefficient of  $-0.93$  with a probable error of  $\pm 0.013$ .

These results indicate that heat intensity is an important factor in determining the time required by the plant to make its growth and that the period of incubation of the cattle tick "is controlled almost entirely by heat intensity. The temperature control of the length of the seed-tick stage is almost as great."

A plea is made for cooperative work along these lines.

Climatic records in the trunks of trees, A. E. DOUGLASS (*Amer. Forestry*, 23 (1917), No. 288, pp. 732-735, figs. 3).—The studies of tree rings briefly reported in this article are thought to indicate a relationship between tree growth, rainfall, and sun spot numbers.

The pleistocene cycle of climatic fluctuations, H. ARCTOWSKI (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 172-179; *Sci. Amer. Sup.*, 85 (1918), No. 2196, pp. 66, 67).—This article deals with studies the essential features of which have already been noted from other sources (*E. S. R.*, 31, p. 717; 32, p. 509).

A preliminary note on soil moisture and temperature factors in the winter-killing of grain crops, S. C. SALMON (*Science*, n. ser., 47 (1918), No. 1207, pp. 773, 774).—Briefly describing and summarizing the results of a general study at the Kansas Experiment Station of the causes of winterkilling of cereals, it is stated that "the preliminary work indicates that a sandy soil is colder and the survival of plants growing upon it less than on a dry clay or loam soil, and also colder than a wet clay or a wet loam during those seasons when the ground remains unfrozen much of the time. It appears probable that dry sand is colder during the winter than a wet sand regardless of the character of the season, but a dry clay or silt loam is colder than a wet soil of the same kind only when the ground remains unfrozen."

Tropical rains: Their duration, frequency, and intensity, O. L. FASSING (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 460-473, figs. 16).—This study has already been noted from another source (*E. S. R.*, 35, p. 619).

Frost in the United States, W. G. REED (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 2, pp. 593-631, figs. 13).—Frost data for selected stations in the United

States are tabulated and discussed, and maps are presented which show (1) the average dates of the last killing frost in the spring and the first in the fall in the United States, (2) the average frostless period, (3) the probable occurrence of the last killing frost in spring and the first killing frost in the fall in one year in ten, and (4) the probable length of the season without killing frost in four years out of five. The business risk involved in planting and harvesting at particular times is discussed.

**Snow surveying: Its problems and their present phases with reference to Mount Rose, Nevada, and vicinity, J. E. CHURCH, JR. (Proc. 2. Pan Amer. Sci. Cong., 1915-16, vol. 2, pp. 496-549, pl. 1, figs. 3).**—The methods and apparatus used by the author in measuring snow and the evaporation from snow fields are described in detail, and the application of the results in forecasting the probable water supply for irrigation is fully discussed. Special attention is given to methods of forecasting, based on seasonal percentage surveys, in which the object is to determine the percentage relationship of a given season's snowfall to that which normally occurs in a watershed applying "the resulting percentage to the normal run-off as measured at the outlet of the basin."

These studies have been noted from time to time from other sources (E. S. R., 36, p. 17; 37, p. 16).

**Snow and its value to the farmer, A. H. PALMER (Sci. Mo., 6 (1918), No. 2, pp. 128-141, figs. 18).**—It is pointed out in this article that, "as a blanket or covering, snow on the ground checks winterkilling. It protects vegetation from extreme temperatures, from excessive evaporation, and from destructive winds, at the same time permitting the penetration of some sunlight and allowing uninterrupted respiration of plant tissue. On twigs and buds it conserves cellular moisture which otherwise might be sacrificed at too rapid a rate during sudden changes of temperature. It mellows the soil, replenishes the ground moisture, checks the run-off from winter rains, furnishes most of the water used for irrigation and power purposes, provides an easy means of transportation, and prevents destructive prairie and forest fires. Grass is benefited by abundant snows, and winter wheat is largely dependent upon it for its success."

**Nitrogen, chlorine, and sulphates in rain and snow, E. L. PECK (Chem. News, 116 (1917), No. 3029, pp. 283, 284).**—The data contained in a continuation from October 20, 1910, to June 8, 1917, of studies on this subject at Cornell College, Iowa, are reported in detail (E. S. R., 34, p. 615).

**Weather review for 1914 and 1915, W. M. ESTEN (Connecticut Storrs Sta. Rpt. 1914-15, pp. 255-270, fig. 1).**—Observations at Storrs, Conn., on temperature, precipitation, and length of the growing season are summarized and tables are given which show the monthly and annual means of temperature and precipitation, 1888 to 1914, and length of the growing season, 1888 to 1915.

The mean temperature for 28 years, 1888 to 1915, was 47.47° F.; highest temperature, 99°, July 3, 1912; lowest temperature, -17°, February 14, 1914; mean rainfall, 44.17 in.; longest duration of growing season 184 days, April 15 to October 19, 1901; average date of last killing frost in spring, May 3; average date of first killing frost in autumn, October 10; and prevailing wind in January, February, March, April, May, August, October, November, and December, northwest; in June, July, and September, southwest; and for the year, northwest.

**Annual report of Iowa weather and crop bureau for 1916, G. M. CHAPPEL (Iowa Yearbook Agr., 17 (1916), pp. 514-573, 579-582, figs. 9).**—This report is made up of the summaries of the monthly and weekly bulletins issued by the Iowa Weather and Crop Service in cooperation with the Weather Bureau of the U. S. Department of Agriculture.

**Meteorological review, C. FLAMMARION** (*Ann. Astron. et Mété.* [Paris], 54 (1918), pp. 299-343, figs. 16).—The conditions of atmospheric pressure, temperature of the air and soil, rainfall, cloudiness, etc., with special reference to the region of Juvisy and the environs of Paris are summarized. The article also contains special notes on the unusually severe winter of 1916-17, extreme variations of temperature in 1916 and 1917, the clear night of December 23, 1916 remarkable solar halos, and a marine tornado.

### SOILS—FERTILIZERS.

**Movement of soluble salts through soils, M. M. McCool and L. C. WHEETING** (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 11, pp. 531-547, figs. 5).—Results are reported of laboratory studies at the Michigan Experiment Station of the translocation of certain salts (including sodium chlorid, potassium chlorid, and sodium carbonate) when added in varying amounts to soils of different texture (heavy and light silt loam, and medium and fine quartz sand) and moisture contents, as well as of changes induced in the composition of the soil solution. The experiments were made in sealed and unsealed containers, maintained in both a horizontal and upright position, known amounts of the different salts being introduced into the center of the soil mass. A study of changes in the concentration of the soil solutions was made by determinations of freezing-point lowerings at various distances from the salt layer and at different intervals of time. In addition, chemical studies were made of the soil solutions obtained by extracting one part of the different layers of soil with one of distilled water, passing the extract through Chamberland filters and determining the amount of certain bases (iron and aluminum, calcium, and magnesium) found therein. The data are presented in tabular form and the results illustrated by graphs.

The authors conclude that the data presented show that soluble salts are translocated from regions of high to those of lower concentration in moist soils when inclosed in sealed containers; and in case of silt loam in the open containers upward movement is very rapid and the downward translocation is marked, the water movement evidently decreasing the downward translocation. . . . In case of the potassium chlorid, the lack of movement reported may have been and probably was due to the retention of the potassium by the soil, other bases being forced into the solution. . . . Such movements are to be expected, especially if the moisture coats the soil particles in the form of films, in view of the fact that diffusion of salts takes place in solution, but on the other hand the movement may not be and probably is not due wholly to diffusion. It does not seem untenable to assume that the reactions which take place when salts are added to the soil play their rôle. A given base coming in contact with a particle or a group of particles may be held and others liberated, adjacent particles may not be satisfied, so far as one or more of these bases are concerned, and by removing them from solution may aid in the translocation of soluble material in the soil.

The chemical studies show that the addition of soluble salts to a given region of the soil results in changes of the composition of the soil solution which may not be confined to the soil mass receiving the application. It seems that such conditions are of far-reaching importance in connection with the results obtained from the use of soluble-fertilizer salts, as well as attempts to bring about a so-called balanced soil solution. Inasmuch as soils undoubtedly vary with respect to the action that takes place when they are treated with various soluble substances, it does not seem possible to work out a balanced soil solution by studying a few soils."

Finally, it is concluded that "soluble salts . . . do not long remain localized, as reported by earlier investigators. Moreover, the rate of movement is affected by the water content of the soil and the mass of salt present. Where moisture is being lost by evaporation, the upward movement is more rapid than the downward translocation in heavier soils; but in case of sands the downward translocation is indeed slight, thus indicating that soluble salts, such as sodium nitrate, are more likely to be lost by upward movement to the surface of sandy soils during a drought than in case of heavier soils. . . .

"The indications are that the translocation of soluble salts in soils is brought about by means of diffusion, by reactions that take place in the soil, and by moisture movements. Field and laboratory experiments in progress should throw additional light upon moisture movement in different soil classes, as well as the upward movement from the subsoil of substances in solution."

**Excess soluble salts in humid soils, S. D. CONNER** (*Jour. Amer. Soc. Agric.*, 9 (1917), No. 6, pp. 297-301).—Experiments conducted at the Indiana Experiment Station are reported, the results of which are taken to indicate that "black soils in humid regions sometimes contain excessive amounts of soluble salts. These soluble salts may cause injury to crops, due to high concentration of nontoxic salts, to a lower concentration of more toxic substances, or to a combination of both. The salts occurring in high concentration are generally nitrates. The toxic salts occur generally in acid soils and are mainly soluble salts of aluminum. The only clay and loam soils that were found to contain excessive soluble salts were of artificial origin, such as spots where old stables had stood."

**Lysimeter investigations, H. K. DEAN** (*U. S. Dept. Agr., Bur. Plant Indust., Work Umatilla Expt. Farm, 1915-16, pp. 14-16*).—Loss of moisture from cropped and uncropped sandy soils of the Umatilla project in Oregon in 1915 (May 2 to the end of the year) and 1916, through percolation and evaporation and transpiration, as determined with concrete lysimeters 3.3 ft. square by 6 ft. deep, was as follows:

*Percolation and evaporation and transpiration (in acre-inches) from lysimeters*

Lysimeter.	Crop.	Water supplied by precipitation and irrigation.		Percolation.				Evaporation and transpiration.			
		1915.	1916.	1915.	1916.	1915.	1916.	1915.	1916.	1915.	1916.
		Inches.	Inches.	Inches.	Inches.	Per cent.	Per cent.	Inches.	Inches.	Per cent.	Per cent.
No. 1.	No crop.	38.75	56.87	26.041	44.565	67.2	78.3	12.709	12.305	32.8	21.7
No. 2.	Soy beans and hairy vetch.	38.75	56.87	19.470	27.219	50.2	47.8	19.280	29.651	49.8	52.1
No. 3.	Alfalfa.	38.75	56.87	13.245	12.400	34.4	21.8	25.505	44.470	65.6	78.1
No. 4.	Alfalfa (matured).	38.75	56.87	13.438	12.062	34.7	21.2	25.312	44.808	65.3	78.1

During 1916 both the irrigation water and the percolate were tested and found to contain calcium, carbonates, bicarbonates, chlorine, sulphates, and nitrates. Less of the bicarbonates, chlorides, and sulphates and more calcium carbonates, and nitrates were found in the percolate than were added in the irrigation water. The greatest amount of nitrates was obtained from the lysimeter growing soy beans and vetch, with the uncropped lysimeter second. Comparatively little nitrate was lost from the lysimeters with alfalfa.

Evaporation from the uncropped lysimeter averaged 0.677 acre-inch per one-week period in 1915 and 0.583 acre-inch in 1916, as compared with an evaporation of 1.811 and 1.403 in. from a free water surface for the same periods. The evaporation and transpiration from the lysimeter with soy beans averaged 1.066 acre-inch per week in 1915 and with soy beans and vetch 1.307 in. in 1916. The evaporation and transpiration of the two alfalfa lysimeters averaged 1.323 acre-inches per week in 1915 and were comparatively constant. In 1916 there was considerable variation, depending upon the amount of water applied, amounting to 1.509 acre-inches per week with 1.5 acre-inch irrigations, 1.672 acre-inches with 2 acre-inch irrigations, and 2.57 acre-inches with 3 acre-inch irrigations. The variations are thought to be due to the fact that the crop received rather less moisture than was required for maximum growth with the 1.5 and 2 acre-inch applications, but an amount greater than the actual needs of the crop with the 3 acre-inch applications.

**Experiments in methods for determining the reaction of soils.** H. R. CHRISTENSEN (*Soil Sci.*, 4 (1917), No. 2, pp. 115-178, figs. 4).—The results of experiments reported in this article indicate the necessity of distinguishing sharply between the absolute acidity of the soil and its ability to free acids.

"The majority of methods suggested for making a quantitative determination of the acidity of the soil give no information as to the content of truly acid-reacting substances in the soil, but only of its ability to absorb bases, which is partly determined by the presence of acid-reacting substances and partly by the presence of nonbase saturate colloids, or other nonacid-reacting but base-absorbing substances. . . . In determining the ability of the soil to absorb bases, a method based on Baumann and Gully's principles, in which acetates are employed, should be preferred."

It is thought probable that free acids exist in sphagnum peat, and the results of the investigations are taken to indicate that the ability of this type of soil to absorb bases is partly dependent on the presence of acid-reacting substances. It is further thought that the ability of a soil to color a neutral litmus solution red is an indication of the presence of free acids.

A determination of the base-absorption power of the soil is not sufficient for determining its lime requirement, for it has been found that many soils which were considered to require lime (such as those not causing *Azotobacter* vegetation under the *Azotobacter* test) possess less power to free acids in a calcium acetate solution than those which do not require lime (such as those causing *Azotobacter* vegetation under the *Azotobacter* test). . . . The qualitative determination of the lime requirement, according to the combined litmus and *Azotobacter* tests, can to a certain extent give information as to the degree of the lime requirement of the soil. . . .

"It is probable that the question of the lime requirement of the soil is predominantly a question of the presence or absence of certain easily decomposed acid-saturating calcium (or magnesium) compounds."

**The nitrogen-fixing bacteria in water and the soil beneath the water.** H. FISCHER (*Centbl. Bakt. [etc.]*, 2. Abt., 46 (1916), No. 11-16, pp. 304-328; also in *Chem. Zentbl.*, 1916, II, pp. 764, 765; *Chem. Abs.*, 11 (1917), No. 15, p. 1511; also in *Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 5 (1917), No. 1, pp. 26, 27).—Experiments are reported in which it was found that soil before the construction of a farm pond contained large numbers of *Azotobacter* while two years after the pond was built very few *Azotobacter* were found and in 1915 they were almost completely gone. Attempts to grow the organism in symbiosis with water plants were unsuccessful. It is concluded that *Azotobacter* plays no important rôle in such ponds.

"Of special significance for the fixation of nitrogen in water is the parasitism or symbiosis between green water plants, especially algae, and short bacilli of the pneumonia group. Their action is not increased by sodium nitrate or artificial fertilization. In Wielenbach it was found that by nitrogen-free fertilizer, with the help of these nitrogen-fixing bacteria, a multitudinous increase of fish was produced. The action of the nitrogen-fixing bacteria shows itself further in a tenfold enrichment of the ground at the bottom of the pond. The significance of free living nitrogen-fixing bacteria, especially the aerobacterial and radiobacterial forms, can be favorably compared with that of the nodule bacilli for the legumes."

**Microorganisms of waste and cultivated peat soils, T. AARV** (*Centbl. Bakt. [etc.]*, 2. Abt., 45 (1916), No. 8-25, pp. 554-574; *abst. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 12, pp. 1744, 1745; *Jour. Soc. Chem. Indus.*, 36 (1917), No. 15, p. 897).—Preliminary trials at the Bremen Experiment Station to ascertain the effect of drainage, liming, and tillage on the bacterial life of peat soils, gave the following general results:

Ammonifying organisms were present in all samples but were far more active in surface soils than in subsoils and in cultivated than in waste land. The breaking up of waste land affected the bacterial life only to a depth of about 8 in. of soil. No nitrifying organisms were found in waste land or cultivated land, except such as received a dressing of more than 0.5 ton of lime per acre. More than 1 ton per acre appeared to be necessary to produce active development of the nitrifying organisms in the peat itself. All the samples tested were able to reduce nitrates. The surface soil of waste land was not much more active than the subsoil, but the surface soil of cultivated land showed much more activity, especially where tillage had been accompanied by liming. Similar relations were observed in respect to the power of decomposing cellulose. As with ammonification and nitrification, the maximum decomposition of cellulose occurred when the soil had previously received a dressing of dung. In no sample of soil was *Azotobacter* present. Surface soils and cultivated soils fermented mannitol more readily than subsoils and waste land, the maximum effect again being obtained with a manured plot.

**Soil sterilization, F. O. OCKERBLAD, JR.** (*Vermont Sta. Bul.* 203 (1917), pp. 14-16).—Studies with greenhouse soil containing approximately 3,250,000 organisms per cubic centimeter are briefly noted, in which steam, phenol, sulphuric acid, formaldehyde, carbon disulphid, and pyridin were employed. The steaming was done in an autoclave for 1, 2, and 5 hours and for half-hour intervals on three successive days, the soil being placed in glass tubes 1 in. wide and 12 in. long and in 8 in. flower pots.

The surface soil exhibited little difference for the several treatments, over 90 per cent of the organisms being killed, while at a depth of 30 cm. (about 1 ft.) wide differences occurred. The 5-hour treatment proved most effective at all depths. The relatively high percentage of organisms killed at depths of 20 and 30 cm. is thought to be due to the penetration of the dry heat through the walls of the glass tube, and that equally good results would be obtained in actual practice is deemed unlikely. The percentage of organisms killed in the pots appeared to be fairly uniform throughout the soil column. Oats grown in pots of steamed and unsteamed soil produced approximately one-seventh more dry matter on the treated soil.

The chemicals were used in solutions of 0.1, 0.5, and 1 per cent, except formaldehyde which was used in 0.4, 0.8, and 1.2 per cent solutions, and were applied to greenhouse beds 5 in. deep, the plots being covered for one and two days. Phenol and carbon disulphid were generally ineffective; pyridin

was somewhat effective at 0.1 per cent strength; and sulphuric acid was fairly effective, a one-day exposure accounting for from 91.3 to 98.7 per cent of the organisms, two-day exposures for from 68.3 to 86.9 per cent. Formaldehyde proved to be most effective, having killed more than 99 per cent of the organisms in four of six trials and 97.2 per cent in a fifth trial. "The gas seems to combine with, or in some way to affect, the albuminous contents of the bacterial cell, thus inhibiting reproduction."

Steam is considered more effective than any chemical, but proved to be cumbersome to use and of limited range. Formaldehyde was estimated to have cost about 1.5 cts. per square yard of application.

Samples of soil taken from plats which had received air-slaked lime, quicklime, and chlorid of lime at the rate of 150 bu. per acre, and representing depths near the surface, from 3 to 6 in., and from 6 to 9 in., showed from 30 to 60 per cent less organisms for the surface of the limed plats than for untreated check plats, but increases in the bacterial population for the other depths ranging from 51 to 408 per cent.

Researches on the equilibrium between the nitrogen and carbon in the soil. P. FELBER (*Mitt. Landw. Lehrkanz. K. K. Hochsch. Bodenkul. Wien*, 3 (1916), No. 1, pp. 23-54; *abs. in Internat. Inst. Agr. (Rome), Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 1, pp. 22-25; *Abs. Bact.*, 1 (1917), No. 4, p. 308).—Analysis of a variety of soils indicated that the carbon-nitrogen relations are fairly constant.

The influence of bacterial activity as indicated by the carbon-nitrogen ratio upon these soils with and without the addition of various substances was determined. In the control test the bacterial activity caused a loss in both organic matter and nitrogen. A similar loss occurred with soy-bean meal. With straw the loss in nitrogen was less. The addition of lime intensified the decomposition of organic matter but did not influence the loss in ammonia. Nitrification, denitrification, and nitrogen fixation were not affected by the lime. The digestion of earth with water at 30° C. for three days showed that the ratio between carbon and nitrogen was altered, there being an increased proportion of nitrogen. Denitrification of saltpeter occurred when it was added in combination with straw meal or dextrose. Without these sources of carbon there was an elimination of carbon but the saltpeter was not destroyed.

The humus content of the soil, H. J. WHITLER (*Proc. Amer. Assoc. Farmers' Inst. Workers*, 21 (1916), pp. 79-90, figs. 2).—This is a lecture dealing with humus, its origin, production, and activity in soil with special reference to its relation to the fertility of different soil types.

Soil survey of the Riverside area, Cal., J. W. NELSON, R. L. PENDLETON, J. E. DUNN, A. T. STRAHORN, and E. B. WATSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1915, pp. 5-88, pls. 4, fig. 1, map 1).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 387,840 acres situated in the western part of Riverside County and the southwestern corner of San Bernardino County. Topographically, it consists mainly of a series of large alluvial fans extending from the surrounding mountains and merging into an extensive, gently sloping plain, while several low mountains occur within the area. As a whole the region is well drained, although local low-lying spots having a high-water table are affected with alkali.

The soils of the area are largely derived from granite, gneiss, and schists, and have been spread over the region as extensive alluvial-fan deposits. Thirty-five soil types representing 13 series are mapped, in addition to river-



wash, rough broken land, and rough stony land. Approximately 90 per cent of the soils are of a loam or lighter texture.

**Soil survey of Bottineau County, N. Dak.,** W. B. COBB, W. I. WATKINS, A. T. STRAHLEN, M. E. STEPHENS, M. THOMAS, and A. C. ANDERSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 5-54, fig. 1, map 1*).—This survey, made in cooperation with the North Dakota Experiment Station, deals with the soils of an area of 1,075,840 acres in north-central North Dakota. The county lies in the glaciated portion of the Great Plains, the topography varying from nearly level to gently undulating in the Prairie Plains region, to undulating to hilly in the Turtle Mountains region. The drainage system is far from complete but adequate to care for the run-off.

The chemical composition of the soils of the county was determined by numerous analyses of both surface and subsoil and is said to compare favorably with that of soils of rich agricultural regions. "Like many of the other soils of the Middle West they are lower in nitrogen and phosphorus than in the other important elements when measured on the basis of standard crop demands. They differ from the soils of the more humid regions in the Middle West in that they contain much larger amounts of calcium and magnesium. They also contain larger amounts of limestone or calcium carbonate. Owing to defective drainage, small areas contain considerable amounts of soluble salts."

The soils of the county are of glacial, or drift and alluvium origin. Eighteen soil types and 7 type phases of 8 series, exclusive of peat and muck, are mapped. Barnes loam, Barnes very fine sandy loam, and Barnes fine sandy loam predominate, occupying 32.5, 22, and 11.6 per cent of the total area, respectively.

**Soil survey of San Saba County, Tex.,** J. O. YEATCH, R. F. ROGERS, M. W. BECK, and H. G. LEWIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 5-67, fig. 1, map 1*).—This survey deals with the soils of an area of 710,400 acres in central Texas lying in the High Plains region of the State, and physiographically is a maturely dissected plateau. The topography of the county varies from rolling or nearly level to deeply dissected, steep and precipitous, with a general elevation ranging from about 1,200 to 1,900 ft. above sea level.

The soils of the county are mainly residual in origin with about one-seventh of the area derived from alluvial deposits. "Clay and clay loam soils predominate, with fine sandy loam next in extent. The greater part of the upland is excessively stony and poorly adapted to farming. With the exception of some of the sandy types, the soils are prevaillingly dark in color at the surface and moderately to highly calcareous. In addition to rough stony land, 34 soil types, one represented by a phase, are mapped. These are classed with 14 soil series."

Crawford stony clay, San Saba stony clay, and rough stony land constitute 15.5, 15.4, and 10.4 per cent of the area, respectively.

**Erosion of Kansas soils.** R. I. THROCKMORTON (*Bien. Rpt. Kans. Bd. Agr., 20 (1915-16), pp. 170-178, figs. 8*).—Erosion of Kansas soils and methods of prevention are discussed, including the terrace method and the earth dam method.

**Soil improvement,** R. W. ALLEN (*U. S. Dept. Agr., Bur. Plant Indus., Work Unatilla Expt. Farm, 1915-16, pp. 8-12, figs. 2*).—The soil fertility problems on the Unatilla project near Hermiston, Oreg., are briefly stated, and yields of clover in 1912, 1915, and 1916, with applications of nitrate of soda, muriate of potash, phosphate rock, lime, tankage, blood meal, and stable manure are reported. The results are deemed inconclusive due to the uneven character of the land from grading for irrigation, but the greatest gain attributed to the fer-

lizer treatments followed applications of 1,000 and 2,000 lbs. of tankage per acre.

Concerning farm manures, R. T. BURDICK (*Vermont Sta. Bul.* 206 (1917), pp. 55-72).—This article, dealing with farm manures, their chemical composition, physical characteristics, preservation, application, and use, under Vermont conditions, is a slightly more detailed account of the same subject previously noted (*E. S. R.*, 16, p. 245). \*

The manufacture of commercial fertilizers, J. L. HILLS (*Vermont Sta. Bul.* 207 (1917), pp. 48, pls. 8, fig. 1).—This bulletin sets forth in a comprehensive manner the present status of fertilizer manufacturing in the North Atlantic States, embracing a discussion of the raw materials; manufacturing processes, including the manufacture of sulphuric acid and a description of the wet, base, and dry-mix processes; and manufacturing and selling costs.

Sterilized animal meal (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, No. 4 (1916), pp. 137-141).—The process of manufacture of so-called sterilized animal meal from the carcasses of dead animals is described.

"The special merits of sterilized animal meal are due to the fact that it is a concentrated organic manure containing high percentages of nitrogen and phosphoric acid, in various degrees of availability. . . . The best results are usually obtained when it is used on light well-drained soils, but it also does well on certain heavier soils."

The fixation of nitrogen, J. E. BUCHER (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 3, pp. 233-239, figs. 16; *abs. in Metallurg. and Chem. Engin.*, 16 (1917), No. 6, pp. 315-317; *Sci. Amer. Sup.*, 83 (1917), No. 2153, p. 215; *Sci. Amer.*, 116 (1917), No. 15, p. 373; *Metallurg. and Chem. Eng.*, 16 (1917), No. 2, p. 82; *Amer. Jour. Sci.*, 4. ser., 43 (1917), No. 256, p. 329; *Sci. Abs.*, Sect. B—*Elect. Engin.*, 20 (1917), No. 235, pp. 231, 232; *Engineering [London]*, 103 (1917), No. 2682, p. 505).—In this paper it is stated that experiments showed that the necessity for electric power in nitrogen fixation may be done away with by using chemical means. The substance of the discovery is that nitrogen will combine with an alkali and carbon in the presence of iron as a catalyst producing cyanid. Soda ash and powdered iron or iron ore were mixed with powdered coke. "Upon heating this mixture in an ordinary furnace and running air over it, the result is cyanid of soda, leaving the iron uncombined. In spite of this fact, that the iron is in the end untouched by the action, if it be omitted no action takes place."

It was further found that letting waste carbon dioxide gas into the sodium cyanid solution resulted in the production of urea.

The synthesis of ammonia by the Haber process, R. O. E. DAVIS and H. BAYAN (*Amer. Fert.*, 47 (1917), No. 7, pp. 29, 30).—This process is described.

Making available the organic nitrogen of leather, hair, wool waste, and muck or peat, R. E. ROSE (*Amer. Fert.*, 47 (1917), No. 7, pp. 24-26).—This is a brief review and discussion of the subject presented in a paper before the fifty-fifth annual meeting of the American Chemical Society.

Solubility of mineral phosphates and superphosphates in dilute mineral and organic acids, A. ATTA (*Ann. Chim. Appl. [Rome]*, 9 (1917), pp. 200-210; *abs. in Jour. Soc. Chem. Indus.*, 36 (1917), No. 15, p. 897).—In each determination 2.5 gm. of the phosphate was digested for 30 minutes at from 14 to 15° C. with 250 cc. of the dilute sulphuric, hydrochloric, formic, acetic, oxalic, tartaric, or citric acid solutions, the mixture being frequently stirred. The mineral acids were used in strengths of 0.01 to 0.1 gm. equivalent per liter and the organic acids in 0.25 or 1 gm. equivalent per liter.

It was found that in the case of the inorganic acids the solubility of the phosphoric anhydrid in superphosphate was comparable with that obtained with the mineral phosphates, after making allowances for such factors as fineness, friability, and proportion of lime. In the case of the organic acids, mineral phosphates behaved in the same way as when treated with inorganic acids, except that there was a slighter dissociation and that the influence of other constituents was more pronounced. Superphosphates, however, behaved in the same way as mineral phosphates toward oxalic acid, but yielded a high proportion of phosphoric anhydrid to the other solutions. For example, the following amounts of the total phosphoric anhydrid were extracted: With formic acid 73.28, acetic acid 62.61, oxalic acid 24.44, tartaric acid 66.43, and citric acid 77.87 per cent.

"The formation of complex citrophosphates in combination with aluminum and ferric iron has been shown (E. S. R., 36, p. 727) to be the cause of the high citric solubility of phosphoric acid, and it would seem that similar complex compounds are formed with organic acids containing atoms of hydrogen not in combination in carboxyl or hydroxyl groups. The solubility of the phosphoric anhydrid in superphosphates is somewhat less than that of mineral phosphates in dilute mineral acids, but the solubility of the phosphoric anhydrid is almost equal in both cases in organic acids which have the property of forming compounds with phosphoric acid, aluminum, and ferric iron."

Fertilizer trials with tetraphosphate in Piedmont rice fields, Italy. MACCARELLI and NOVELLI (*Gior. Riscolt.*, 6 (1916), No. 21, pp. 321-327; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 2, pp. 230, 231; *Jour. Soc. Chem. Indus.*, 36 (1917), No. 15, p. 897).—Experiments were made in an extremely acid soil, very poor in lime, growing rice. The field was in a fertile condition at the commencement of the experiments, having received a dressing of mineral superphosphate and barnyard manure during the previous winter. Three equal areas of the field were sown with paddy rice and manured, respectively, with 500 kg. per hectare (445 lbs. per acre) of tetraphosphate containing 2 per cent of citrate soluble, 7.8 per cent of citric acid soluble, and 28.3 per cent total phosphoric acid, the same amount of ground phosphorite, and 930 kg. of superphosphate. The amount of marketable grain obtained from the tetraphosphate plot was 6,330 kg., from the ground phosphorite plot from 5,730 to 5,906 kg., and from the superphosphate plot 5,600 kg.

What we are doing toward remedying the potash shortage, R. K. MEYER (*Commercial Fert.*, 15 (1917), No. 3, pp. 40, 44, 46, 50).—This is a brief review of the details of the different new potash industries of the United States. It is believed "that the largest future source of cheap potash available in the country is in the iron industry and cement industry, which could be made to produce almost all of the potash formerly imported from Germany. Other promising sources of small amounts are from the evaporation of brines and from beet-sugar waste. There is always the possibility, too, that some of the processes now proposed for the manufacture of potash direct from greensand or feldspar will prove commercially successful."

A new source of potash, H. T. CRANFIELD (*Jour. Bd. Agr. [London]*, 24 (1917), No. 5, pp. 526-530; *abs. in Nature [London]*, 100 (1917), No. 2501, p. 92).—The author is of the opinion that the flue dust of blast furnaces is the most important source of potash yet discovered in Great Britain. Analyses of flue dusts are given in the table following.

*Analyses of flue dusts.*

Kind of potash.	Kind of flue dust.											
	Cream.	Black.	Red.	Black.	Black (burnt).	Black.	Black.	Cream.	Red.	Gray.	Light brown.	Gray.
Water soluble..	P. ct. 9.25	P. ct. 5.92	P. ct. 8.90	P. ct. 1.68	P. ct. 5.12	P. ct. 2.01	P. ct. 1.23	P. ct. 5.69	P. ct. 4.68	P. ct. 5.88	P. ct. 3.82	P. ct. 4.70
Total acid soluble.....	15.89	3.13	8.90	2.97	5.12	3.73	3.13	11.82	7.58	12.46	7.51	7.10

It is estimated that there are 300 furnaces in full blast in Great Britain and that each produces 20 tons of black, 5 tons of red, and 1 ton of cream-colored flue dust per week. On the basis that the black dust contains 2.5, the red 7, and the cream-colored 10 per cent of potash, their total annual production would be about 15,000 tons of potash, of which at least 50 per cent is considered to be available.

**Commercial fertilizers, P. L. HUBBARD** (*California Sta. Bul.* 286 (1917), pp. 117-166).—This reports the results of fertilizer inspection work for the year ended June 30, 1917. A total of 506 samples of fertilizers and fertilizer materials was received, 460 being official samples. Deficiencies greater than those allowed by law occurred in 126 samples.

**Fertilizer analyses, H. B. McDONNELL ET AL.** (*Md. Agr. Col. Quart.*, No. 77 (1917), pp. 31).—This is a report of the fertilizer inspection and analysis in Maryland for the period from February, 1917, to June, 1917, inclusive.

**Commercial fertilizers, J. L. HILLS, C. H. JONES, and G. F. ANDERSON** (*Vermont Sta. Bul.* 206 (1917), pp. 5-52, pls. 4).—Analyses of 171 licensed brands of fertilizers, representing the output of 18 companies and sold in Vermont during 1917, are reported. The quality of the crude stock used is reported as being beyond reproach. All but 4 of the 171 brands carried appreciable amounts of mineral as well as of organic forms of nitrogen, and about  $\frac{1}{2}$  contained potash. Guarantees were met in 81 per cent of the brands tested. The average selling price was \$32.05, but no trade valuation was made owing to the unsettled conditions of the fertilizer industry.

## AGRICULTURAL BOTANY.

**Plant associations of western Pennsylvania with special reference to physiographic relationship, II, J. E. CRIBBS** (*Plant World*, 20 (1917), No. 5, pp. 142-157, figs. 3).—The author states that plant associations of western Pennsylvania bear a close relation to the topographical features of that region, so that a given type of vegetation may be expected to grow in widely separated similar environments. This is due to its close relationship to certain factors which are practically decisive.

Desiccation produces much the same result whether due to wind or to sunshine. Soil composition produces no striking differences. Relative humidity resolves itself into a question of soil moisture, which is the most important of the factors determining, directly or indirectly, the composition of the associations. High soil humidity inhibits oxidation, so that acids and other plant by-products accumulate in sufficient quantity to exert possibly a direct influence upon the vegetation. Decay processes may draw oxygen from the supply in the water sufficiently to affect growth. Retention of detrimental materials in the soil is

perhaps a principal hindrance to growth. The relative coldness of the waters from the ravine slopes may be an influence modifying that of soil moisture.

The climax formation of western Pennsylvania is a mesophytic deciduous forest of which *Acer*, *Fagus*, *Castanea*, and *Quercus* are the dominant members. The composition of the climax formation is directly referable not to physiological but to climatic conditions.

A list of Japanese fungi, M. SHIRAI and I. MIYAKE (*Tokyo*, 1917, 2. ed., pp. 733+78).—This consists of an alphabetical list of species of fungi known to occur in Japan.

Self-sterility, C. W. MOORE (*Jour. Heredity*, 8 (1917), No. 5, pp. 203-207, figs. 3).—A study of *Tradescantia*, *Trifolium hybridum*, *Medicago sativa*, and *Papaver rhæas*, regarding their capacity for cross-fertilization as compared with that for self-fertilization, showed differences in this respect in favor of the former method which were notable in case of *Tradescantia* and somewhat less so in *Trifolium*. These and other observations noted are thought to be capable of interpretation either on the ground of an inhibitor in the pollen grain or stigma which in some cases prevents a pollen grain from extending itself to the stage of self-pollination, or else on that of an early deficiency of food supply for the tube and its consequent stoppage of longitudinal growth short of the point where self-fertilization is possible. The latter explanation is considered as the more probable, the greater thickness of the pollen tubes in *Tradescantia* indicating that the food supply is more favorable to the nourishment of a self-pollen tube than it is to that of a cross-pollen tube. The tubes thus express their growth chiefly in thickness and fail to carry the nucleus to the embryo sac.

Artificial production of galls, M. MOLLIARD (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 4, pp. 160-162, fig. 1).—Larvæ of *Aulax papaveris* were crushed in a small quantity of water which was then filtered under pressure and forced into the pistil (some entering the ovary) of *Papaver rhæas*. This developed a decided hypertrophy in certain of the placental lamellæ resembling the effects produced by the presence of the larvæ themselves. Similar results were obtained with *P. somniferum*, which is said not to be attacked by *A. papaveris*.

The movement of chromatophores, C. SAUVAGEAU (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 4, pp. 158, 159, fig. 1).—*Saccorhiza bulbosa* is said to exhibit in a remarkable degree the tendency to contract its chromatophores rapidly and considerably on exposure to strong diffused light, this change being reversible in darkness.

Physiology and biology of nitrogen-fixing bacteria, V. L. OMELENSKI (*Arch. Sci. Biol. [Petrograd]*, 19 (1915), No. 2, pp. 162-208, pl. 1; abs. in *Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 7, pp. 944, 945; *Jour. Soc. Chem. Indus.*, 36 (1917), No. 1, p. 40).—The author has endeavored to make a digest of the large amount of existing information on the physiology and biology of *Azotobacter chroococcum*, supplementing this by the results of his own researches. The subjects dealt with are the methods of accumulation of *Azotobacter* in selected culture, methods of isolation, growth in solid and liquid media, and influence of temperature and aeration. The most attention is devoted to the fixation of free atmospheric nitrogen, and in particular the conditions insuring the highest efficiency of the species under study, with reference not only to the absolute quantity of nitrogen fixed but also to the quantity of nonnitrogenous substances oxidized.

Relations between nitrogen fixation and the consumption of nonnitrogenous organic substances by nitrogen-fixing bacteria, V. L. OMELENSKI (*Arch. Sci. Biol. [Petrograd]*, 18 (1915), No. 4, pp. 327-337, figs. 2; abs. in *Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 7, pp.

344, *Ag. 1*; *Jour. Soc. Chem. Indus.*, 36 (1917), No. 1, p. 40).—Experiments using *Azotobacter chroococcum* and *Clostridium pasteurianum* together are reported. The nutritive medium used was composed of 80 cc. drinking water, 20 cc. 5 per cent linseed extract, 2 gm. dextrose, 0.1 gm. potassium phosphate, 0.6 gm. magnesium sulphate, and 0.5 gm. calcium carbonate. Incubation at from 21 to 22° C. lasted about six weeks.

It was found that a close relation exists between the processes of assimilation and disassimilation in the cell. The process of fixation of nitrogen ran its course uninterruptedly until the available energetic substance was consumed. The quantity of nitrogen fixed was relatively small (1.735 mg. of nitrogen per gram of sugar decomposed), which is attributed to the low degree of activity of the bacterial strains employed in the experiments. Nitrogen fixation and sugar decomposition were parallel and showed a continuous increase throughout the experiment, the maximum taking place in the period between the fifth and fifteenth day.

A comparison between the productivity of the work of the bacteria at different periods of five days each showed that the process of nitrogen fixation was at its best in the first period. "The efficiency of the bacteria declines rapidly during the three following periods, after which, during the final period, it remains at nearly the same level. It may be said, therefore, that during the first periods of growth of the bacteria in question in the nonnitrogenous medium, when the cells of the nitrogen fixers multiply energetically, their work is most efficient. The impression of the low efficiency of the work of these microbes gained from examining the ratio  $\frac{+N}{-C}$  at the close of the experiment must be due to the depressing influence resulting from the process being in its last stages."

Fixation of atmospheric nitrogen by mixed cultures, V. L. OMELANSKI (*Arch. Sci. Biol. [Petrograd]*, 18 (1915), No. 4, pp. 338-377, pl. 1; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 7, pp. 342, 343; *Jour. Soc. Chem. Indus.*, 36 (1917), No. 1, p. 40).—Studies on the fixation of nitrogen in cultures of a large number of races of *Azotobacter* and *Clostridium pasteurianum* isolated from different Russian soils, associating with them many other microorganisms usually accompanying them in soils, are reported.

It is concluded that "the study of the biochemical reactions by means of which the bacteria in mixed cultures fix atmospheric nitrogen brings out clearly the various aspects of the natural process occurring under conditions of combined action of the different organisms. The organisms acting in combination with the nitrogen-fixing bacteria in upper soil strata are very numerous and they play an extremely important part in the life of the soil. The synergetic activity of nitrogen-fixing and accompanying microbes is, both in laboratory experiments and under natural conditions (cultivable stratum of the soil), of a different character according to the properties of the species taking part in the process and their environment. In other cases the function of the satellite organism seems to consist in fixing the oxygen of the air and in creating the anaerobic environment (for *C. pasteurianum*). The species added to the cultures of nitrogen-fixing microbes sometimes supply the compounds of carbon needed for the process of fixing nitrogen as energetic substance.

In the case of the combination, *Azotobacter* and *C. pasteurianum*, the function of the former is not confined to fixing the oxygen of the air only and consequently to creating an anaerobic environment for the *Clostridium*, but this combination is also useful inasmuch as it destroys the injurious

products of dissimilation created by the second (chiefly butyric acid) and maintains the action of the environment (*Azotobacter* is alkaligenic and the *Clostridium acidogenicum*). The satellite species may also unfavorably affect the nitrogen-fixing organism, either through products of assimilation or by consumption of the carbon compounds needed for nitrogen-fixing. The energetic fixation of oxygen by the satellite aerobic species creates conditions favorable to the development of *C. pasteurianum*, but at the same time hinders the growth of the *Azotobacter*, which is necessarily aerobic. The form endowed with the maximum vitality and at the same time the most common form in which combination of the nitrogen-fixing organisms takes place in the upper soil strata is that of symbiosis between the aerobic and anaerobic nitrogen fixers, principally between *Azotobacter* and *C. pasteurianum*. In spite of the opposite properties of the two species, their synergetic activity in the upper strata of the soil results in a harmonious mutual development producing the maximum economy in consumption of energetic substances."

**Distribution of nitrogen-fixing bacteria in Russian soils.** V. L. OMELENSKII and M. SOLUNSKOV (*Arch. Sci. Biol. [Petrograd]*, 18 (1915), No. 5, pp. 459-462; *pls. 3*; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 7, pp. 941, 942; *Jour. Soc. Chem. Indust.*, 36 (1917), No. 1, p. 40; *Chem. Abs.*, 11 (1917), No. 9, p. 1233).—Studies conducted at the Imperial Institute of Experimental Medicine, Petrograd, are reported on the occurrence of *Clostridium pasteurianum*, an anaerobic, nitrogen-fixing bacterium, and *Azotobacter chroococcum*, an aerobic, nitrogen-fixing bacterium in soils taken from different depths in 12 different localities of European and Asiatic Russia.

It was found that "*Azotobacter* and *C. pasteurianum* occur very widely in soils of different characters and in the most divergent regions of the Empire. In some few cases only the nitrogen-fixing agent was isolated, for instance *Azotobacter* in the sands of the Kirghiz Steppes and in the peat soils in the north of European Russia (Province of Archangel). The races of *Azotobacter* and *C. pasteurianum* isolated in the inquiries are clearly morphologically distinct, especially those of *C. pasteurianum*. In these experiments, the two bacteria studied exhibited a different fixing power, weaker in *Azotobacter* than in *C. pasteurianum*, but the figures were very close (1 to 8 mg. of nitrogen per gram of sugar decomposed)."

**The action of some oligodynamic elements on nitrogen-fixing bacteria.** C. MONTANARI (*Staz. Sper. Agr. Ital.*, 50 (1917), No. 2, pp. 69-72; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 6, pp. 838-840).—Two years' experiments are reported with copper, barium, zinc, lead, and arsenic, using a white, siliceous sand which was so treated as to obtain the best conditions for nitrification. The elements were added either at the beginning of the experiment, at the moment of inoculation, or after nitrification had set in and developed strongly, at rates of 0.01, 0.05, and 0.1 gm. per 100 gm. of sand.

It was found that "the action of some of the elements varied fairly considerably according to whether they were added at the beginning of the experiment or when nitrification was already in progress. In the first case, the addition of copper, even in small quantities, of barium, zinc, lead, and arsenic, the latter in larger quantities only, had a marked inhibiting effect. In the second case, however, owing to its vigorous development, the organism was unaffected except by the largest quantities of arsenic and copper. In none of the experiments did the various elements, even when added in the smallest quantities, have a stimulative or favorable effect on the development of the organisms.

Manganese sulphate was the only exception to this rule. This accounts for the prejudicial action of these elements on nitrogen bacteria."

See also a previous report of experiments with manganese (E. S. R., 33, p. 422).

**The germination of seeds in saline solutions**, P. LESAGE (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 17, pp. 639-641).—The results of a preliminary study of concentration limits of germination of seeds of *Silene gallica*, *Clarkia pulchella*, *Gilia capitata*, and *Linum usitatissimum* in solutions of electrolytes or nonelectrolytes are given in tabular form.

**Assimilation of nutrients by [rice] plants**, J. SEN (*Rpt. Agr. Research Inst. Ind. Col. Pusa, 1915-16*, pp. 16-18; *Trop. Agr. [Ceylon]*, 48 (1917), No. 3, pp. 179, 180).—A study made of the assimilation of nutrient material by the rice plant at six stages of its development is said to show that the total amount of dry matter in the plant increases up to the time of maturity, the largest increase occurring before the flowering period. Nitrogen decreases continuously, the most rapid decline being noted during the transplantation stage. The parts above ground always exceed the roots in their nitrogen content. The leaves in their earlier stages are twice as rich in nitrogen as the stems. Both leaves and stems lose nitrogen during the formation of the grains, which, when they are about three times as rich in nitrogen as the other parts of the plants. The amount of phosphoric acid was low throughout these tests. Potash increases to the preflowering stage, after which it declines.

By the time the flowers appear the assimilation of nitrogen, phosphoric acid, and potash is fairly complete, so that the supply of these must be available before this time. It does not appear that nitrogen or potash migrates back to the soil. For a yield of 900 lbs. of dry grain, the soil suffers a depletion of 20.3 lbs. nitrogen, 9.64 lbs. phosphoric acid, and 49.69 lbs. potash per acre by the total removal of both grain and straw.

**Some sources of ethylgalactosid**, MOUCHE (*Jour. Pharm. et Chim.*, 7, ser., 15 (1917), No. 11, pp. 345-348).—Ethylgalactosid  $\beta$  has been obtained in a pure and crystalline state from the products of fermentation in which the presence of galactosid  $\beta$  has been demonstrated. This has been done in the case of a number of plants, some of which are named. The technique of the work is also briefly indicated.

**Industrial fumes and injury therefrom to vegetation**, V. SABACHNIKOFF (*Rev. Agr. et Rurale*, 7 (1917), No. 22, pp. 390-393).—After a general account of kinds of industrial works giving rise to various substances mentioned as injurious to vegetation, the author states that the effects due to the noxious gases are more important than those due to the corroding influence of even high concentrations of certain acids. The total of the cumulative effects of even weak concentrations of acid gases in the air is said to be very great.

## FIELD CROPS.

**Experiments in field technique in rod row tests**, H. K. HAYES and A. C. ARMY (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 9, pp. 399-419).—Preliminary investigations in 1915 with wheat and oats grown in replicated and single rod rows and in duplicated and single  $\frac{1}{16}$ -acre plats at the Minnesota Experiment Station led to more detailed studies in 1916 of the effects of competition on height and yield between adjacent rows of different varieties and strains of wheat, oats, and barley planted in rod rows when spaced at a distance of 1 ft. apart and of the value of replications for rod row tests. The data were obtained from rod row variety tests made by the farm crops section and from rod row tests made in the plant breeding nursery. This report forms the



first of a series of investigations of field practices in Minnesota to ascertain any lack of uniformity in methods of work.

"In a study of competition between row rows of small grains grown 1 ft. apart there was some effect on the yield of border rows of the same variety due to height of adjacent rows of barley, winter wheat, and, in one of two tests, an indication of such effect in oats. The results were variable in different plots, such variation being due possibly to the environmental conditions. There was no apparent effect of height of adjacent rows on the yield of border rows of the same variety in spring wheat. The yield of adjacent rows appeared to be of some importance in barley tests and in the farm crops spring-wheat tests. Correlations obtained for other tests indicated considerable soil heterogeneity. The effect of the height of adjacent rows for the barley plant breeding tests was unquestionable. The effects of the height of adjacent rows were sufficient to often cause differences of 4 or 5 bu. per acre in the yield of border rows of the same variety of barley. The comparison of yield variability of border and central rows of check plots of barley, oats, spring, and winter wheat was further evidence of the competitive effect of row rows of small grains when grown 1 ft. apart. In nearly all tests the border rows proved to be more variable in yield than the central rows.

"In nearly all tests three replications as compared with a single plot reduced error by from 25 to 50 per cent.

"In a study of replications for row rows of small grains considerable variability was shown for the different tests. In general three or four replications seem to be about as accurate a method as the use of any number below nine. The indications are that from 9 to 12 replications would reduce error due to soil heterogeneity to a minimum."

A bibliography of 16 titles is appended.

Improved technique in preventing access of stray pollen, A. WALKER and L. E. THATCHER (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 4, pp. 191-195, pl. 1).—A waxed paper capsule for the prevention of contamination by adventitious pollen and used by the authors in plant breeding work at the Ohio State University is described and illustrated. Advantages claimed for this device are as follows:

The translucent paper capsules hinder very little the normal plant processes and are cheap, light, and durable. No other method known to the authors will protect against pollen thrips or other small insects that interfere with pedigree cultures. Isolation of the inflorescence in the capsules obviates the necessity of locating the cultures in places unfavorable for the plant and inconvenient for observation. The capsule makes possible the isolation of flowers borne on shrubs and trees. The device also protects the developing and ripened fruit.

[Field crops] work of the San Antonio experiment farm in 1916, C. R. LETTER (*U. S. Dept. Agr., Bur. Plant Indus., Work San Antonio Expt. Farm. 1916*, pp. 1-16, figs. 3).—This reports the progress of work continued along the same general lines followed in preceding years (*E. S. R.*, 35, p. 827), including meteorological observations in 1916. Seasonal conditions for 1916 are noted as in many respects very unfavorable for crop production.

Experiments relating to crop rotation and tillage, and corn and cotton culture and variety tests are described, and results obtained in the main similar to those previously noted. The 1916 yields of corn, cotton, sorghum, and oats for grain were slightly higher on biennially cropped land than on land cropped annually, although the differences in favor of the biennial cropping were not deemed sufficient to make the practice profitable.

In field plat tests with flax varieties, yields were obtained amounting to 5.4 bu. per acre for Select Russian (C. I. No. 3), 5 bu. for Smyrna (C. I. No. 30), 4.7 bu. for North Dakota Resistant No. 114 (C. I. No. 13), 2.3 bu. for Punjab (C. I. No. 20), and 0 for Soddo White (C. I. No. 36), with estimated stands of 75, 30, 95, 20, and 0 per cent, respectively. Eight of 12 additional varieties grown in single nursery rows sustained a loss in stand of from only 5 to 10 per cent, with yields estimated to vary from 10.2 to 5.7 bu. per acre. Arranged in order of highest yield these varieties were C. I. Nos. 18, 19, 25, 3, 12, 16, 27, and 14. In date-of-seeding tests with flax, seedlings of 25 lbs. per acre of North Dakota resistant No. 114 were made at 15-day intervals beginning October 15 and ending January 5. The yields varied from 0 for the January 5 planting to 9.3 bu. per acre for the November 15 planting.

In variety tests with field peas the Kaiser and Gray Winter were the only varieties to withstand successfully the winter temperatures of 1915-16. The former yielded at the rate of 2,100 lbs. of cured hay and 3.8 bu. of peas per acre and the latter at the rate of 1,800 lbs. of hay and 1.25 bu. of seed per acre. Kerrville, although severely injured by frost, yielded at the rate of 1,600 lbs. of hay and 2.5 bu. of seed.

[Report of field crops work at the Umatilla experiment farm, Oreg., in 1915 and 1916], R. W. ALLEN (*U. S. Dept. Agr., Bur. Plant Indus., Work Umatilla Expt. Farm, 1915-16, pp. 16-18, 22-27, 32-37*).—This reports the results of crop rotation experiments by H. K. Dean and numerous variety tests with corn, grain sorghums, and miscellaneous forage crops.

The crop rotation experiments begun in 1915 were planned to study the effect of the combination of crop, manure, and cover crops on crop yield and on the physical condition of the soil. The plats are irrigated by an underground pipe system. Applications of manure amounting to 8 and 32 tons per acre resulted in very pronounced increases in the yields of alfalfa and feterita grain and fodder for 1915 and 1916, with the plats receiving 8 tons yielding more in proportion to the manure used than those receiving 32 tons.

Crops for soil improvement, the harvesting of hairy vetch for seed, and variety tests with soy beans, field peas, vetches, and minor leguminous crops are briefly noted. Variety tests with soy beans in 1915 resulted in yields of hay amounting to 4,823.5 and 4,654 lbs. per acre for Medium Yellow and Auburn, respectively. The highest-yielding variety of field peas in 1915 was Canadian with 4,409 lbs. of hay per acre.

In variety tests with corn for silage during 1913-1915, inclusive, Pride of the North has given the largest yield, although Reid Yellow Dent proved equally as good in 1915. Silver King, with 980 lbs. of grain on the cob, showed the highest grain yield in 1915. Of the sorghum varieties tested in 1915, Red Amber was first in yield of forage with 19,658 lbs. per acre green weight and 10,633 lbs. of stover. Dakota Amber was first in yield of grain, with 1,502 lbs. per acre, and Dwarf hegari second with 1,401 lbs. For new land or coarse land without a high-water table these last are deemed much more desirable than corn, although for productive land corn is regarded as a more satisfactory crop.

Sudan grass sown in 3 ft. rows in 1916 and irrigated at intervals of one, two, and three weeks showed yields amounting to 1,500, 2,800, and 3,000 lbs. of cured hay per acre, respectively, and when sown broadcast yields amounting to 2,200, 2,300, and 3,900 lbs. per acre, respectively. Sown in rows in 1915 Sudan grass gave a yield of 2,228 lbs. of cured hay per acre, including 500 lbs. of seed. A plat from which a solling crop was taken in July yielded at the rate of 1,757 lbs. of cured forage per acre and 137 lbs. of seed.

Cooperative tests with Sudan grass, Dakota Amber sorghum, Dwarf hegari, and feterita were conducted by farmers on irrigated and nonirrigated lands of eastern Oregon during 1915. Sudan grass is said to have done very well on dry farms but was not so uniformly successful under irrigation. Dakota Amber and Dwarf hegari proved to be superior to feterita under both irrigated and nonirrigated conditions.

Field tests with Japanese sugar cane, teosinte, broom corn, and millet are briefly noted, but none of these crops is deemed suited to the region.

[Field crops work for 1916], D. A. GILCHRIST (*County Northumb. Ed. Com. Bul. 24* (1916), pp. 6-34, 42-49, 51-53, 54-77).—This reports extensive fertilizer tests on poor pasture lands and old meadows; variety tests with oats, barley, wheat, beans, and root crops; cultural tests with potatoes; tests of the competition of swedes and turnips as affected by varietal, seasonal, and manurial differences; and studies of the manurial requirements of all crops grown in rotation and of the residual value of manures conducted in Northumberland during 1916.

Basic slag has given the best results with poor pastures on heavy soils, while on the lighter soils basic slag with potash has proved most effective. Active nitrogenous fertilizers are said to have depreciated the feeding value of hay on old meadow lands, while phosphatic fertilizers, supplemented with potash when necessary, have greatly developed clover and improved the feeding value of the hay. Basic slag as a supplement to manure has given the best results on old meadow lands. The residual effects of feeding oil cake to grazing stock have not proved as beneficial as was expected.

Early plantings of potatoes gave increased yields over medium and late plantings. Sprouted seed increased the yield more than a ton per acre over unsprouted seed. Injuries from late frosts resulted in a reduction of nearly 50 per cent in the total crop, and in the proportion of large tubers from about 86 to about 60 per cent of the total.

[Field crops work for 1917], D. A. GILCHRIST (*County Northumb. Ed. Com. Bul. 26* (1917), pp. 20-34, 42-77).—A continuation of work noted above.

Field experiments, 1916 (*Dept. Agr. and Tech. Instr. Ireland Jour.*, 17 (1917), No. 2, pp. 242-256).—Continuing work previously noted (*E. S. R.*, 36, p. 529), variety tests with barley, mangels, oats, turnips, potatoes, and wheat, and manurial and cultural tests with potatoes and wheat are reported from numerous centers for 1916.

Tests with sprouting seed potatoes showed an average increase in yield for the 13-year period 1903-1915 of nearly 2 tons per acre over unsprouted seed. Cultural tests, including the use of sprouted seed, the application of 20 tons of manure and 6 cwt. of a standard fertilizing mixture, and with the crop sprayed twice at an estimated cost of \$20 per acre, yielded an average increase of 4 tons of potatoes over plots seeded with whole, unsprouted tubers, with 20 tons of manure only and unsprayed. Change-of-seed experiments are reported from which it was concluded that where sufficient attention is devoted to the selection of home-grown seed, seed importations are unnecessary.

Comparative tests of farmyard manure and seaweed as a fertilizer for potatoes in the 4-year period 1912-1915 indicated that with applications of equal amounts seaweed did not produce quite so heavy a crop as the manure, but that when seaweed was used with commercial fertilizers muriate of potash could be omitted without any material reduction in yield. A standard mixture of 1 cwt. of sulphate of ammonia, 4 cwt. of acid phosphate, and 1 cwt. of muriate of potash, together with farmyard manure, is recommended for potatoes on most of the soils of Ireland. On peaty soils the above mixture has

given good results, especially when applied at the rate of 9 cwt. per acre. Basic slag was found to be inferior to acid phosphate, and nitrate of soda to sulphate of ammonia on peaty soils.

Red Marvel spring wheat gave the highest yield, with about 48.5 bu. per acre, with Red Fife second with about 47.6 bu., while of the winter wheats tested White Stand-up, with a yield of approximately 45.7 bu., and Queen Wilhelmina, with about 44.8 bu. were best. Fertilizing wheat after root crops was not deemed profitable, but after grass or another grain crop an application of from 2 to 3 cwt. of acid phosphate supplemented by 1 cwt. of sulphate of ammonia in the spring is recommended.

**Agricultural experiments.**—Report for year 1915-16, W. J. SPAFFORD, A. A. KESBY, F. COLEMAN, and L. J. COOK (*Jour. Dept. Agr. So. Aust.*, 20 (1917), No. 5, pp. 602-613).—Variety tests with potatoes, oats, barley, and wheat, and fertilizer tests with potatoes and wheat are reported for three experimental seasons in South Australia.

The highest potato yield, approximately 8,337 lbs. per acre, was secured from an application of 6 cwt. of lime and 1 cwt. of sulphate of potash as compared with a yield of about 8,071 lbs. obtained from the untreated check.

The highest average wheat yield, 26.55 bu., in fertilizer tests extending over a period of 12 years, 1905-1916, inclusive, was obtained from an application of 1 cwt. of rock phosphate, 0.5 cwt. of sulphate of potash, and 0.5 cwt. of nitrate of soda. A yield of 15.17 bu. was obtained from the untreated check.

[Field crops work at the Coimbatore Agricultural Station], R. C. WOOD (*Dept. Agr. Madras, Rpt. Coimbatore Agr. Sta.*, 1913-14, pp. 38; 1914-15, pp. 27; 1915-16, pp. 22; 1916-17, pp. 19).—In a continuation of work previously noted (*E. S. R.*, 31, p. 733), variety, cultural, and fertilizer tests are reported with rice, millet, wheat, ragi, cumbu, cotton, gram, sugar cane, and miscellaneous fodder crops for the period of 1913 to 1917, inclusive. Brief notes on meteorological conditions for the period are included.

[Field crops work at the Hagari Agricultural Station], G. R. HILSON (*Dept. Agr. Madras, Rpt. Hagari Agr. Sta.*, 1913-14, pp. 22; 1914-15, pp. 16; 1915-16, pp. 25; 1916-17, pp. 20).—Variety and individual selection tests with cotton, grain sorghums, ragi, potatoes, and sugar cane; tests of oil cake and sheep and cattle manure as organic fertilizers; rotation tests with sorghum, gram, millet, and cotton; cultural tests with millet and ragi; and fertilizer tests with sugar cane are briefly reported for the period of 1913 to 1917, inclusive.

Higher yields of sorghum, grain and forage, were obtained with sheep manure than with oil cake or cow manure. The highest yields of grain and fodder were obtained from rotations of sorghum with Bengal gram. Peanuts used as a green manure for sugar cane, and supplemented by 200 lbs. of acid phosphate gave increased yields of cane over green manuring alone.

[Field crops work at the Nandyal Agricultural Station], G. R. HILSON, D. ANANDA RAO, and K. RAMASASTRULU NAYUDU (*Dept. Agr. Madras, Rpt. Nandyal Agr. Sta.*, 1913-14, pp. 9; 1914-15, pp. 10; 1915-16, pp. 8; 1916-17, pp. 3).—Cultural, variety, and manurial tests with sorghum, cotton, and miscellaneous cereal and fodder crops are reported for 1913 to 1917, inclusive, with a brief discussion of local agricultural conditions.

**Experiments with clovers and grasses.** F. G. STEBLER (*Landw. Jahrb. Schweiz*, 31 (1917), No. 1, pp. 1-43, figs. 11).—Comparative field tests of French, Spanish, Syrian, Persian, and South Russian alfalfas, eight different clovers, and six grasses are reported. The tabulated data show the green and air-dried weight of the forage, together with a report on the percentage of purity and germinability of the seed, the percentage of usable seed, and the weight of 1,000 seeds for each variety tested.

**Concerning alfalfa and soy beans, J. L. HILLS** (*Vermont Sta. Bul.* 204 (1917), pp. 40-72).—This article is a compilation of general information relating to the production and use of alfalfa and soy beans, with special reference to Vermont conditions.

**Irrigation of alfalfa, S. FORTIER** (*U. S. Dept. Agr., Farmers' Bul.* 865 (1917), pp. 40, figs. 36).—A revised and abridged edition of Farmers' Bulletin 373 (*E. S. R.*, 22, p. 135). The use of portable pipe for irrigating alfalfa in regions where water is pumped at considerable expense is described. Additional data are presented on the amount of water required as indicated by field tests at several experimental centers.

**Influence of the frequency of irrigation on the yields of alfalfa, R. W. ALLEN** (*U. S. Dept. Agr., Bur. Plant Indus., Work Umatilla Expt. Farm, 1915-16*, pp. 18, 19).—Three years' experiments, designed to show the influence of the frequency of irrigation on yields of alfalfa, showed "the highest duty of water to result from irrigating alfalfa at intervals of three weeks, while the greatest return from the land comes from irrigating weekly. The amount of hay produced by weekly irrigations over that derived from biweekly irrigations averages but 0.56 ton for the three years and does not warrant the additional labor of applying the extra 10 irrigations and the 3½ ft. of water used. This excess labor and water are approximately sufficient to produce 4.76 tons of hay per acre when applied to other land. Biweekly irrigations are definitely shown to give the best results from the labor and water involved."

**Bean growing in eastern Washington and Oregon and northern Idaho, L. W. FLUHHARTY**, revised by B. HUNTER (*U. S. Dept. Agr., Farmers' Bul.* 567 (1917), pp. 16, figs. 3).—A revision of Farmers' Bulletin 561 (*E. S. R.*, 30, p. 138).

**Red clover experiments.**—A second series of investigations relating to the improvement of red clover, H. M. GMELIN (*Cultura*, 28 (1916), No. 34, pp. 41-430; 29 (1917), Nos. 341, pp. 1-21, figs. 8; 342, pp. 49-62; 343, pp. 73-85).—Continuing work previously noted (*E. S. R.*, 33, p. 131), the author reports rather extensive observations of inheritance of flower color (white and red), leaf spot, and compound leaves with more than three leaflets in red clover. Further observations are reported on the isolation of individual plants, the crossing of different clover varieties, the verification of seed color, and the grain weight of different clover races.

**Selecting corn seed, E. B. BARCOCK** (*California Sta. Circ.* 180 (1917), pp. 7, figs. 3).—A brief, popular discussion on the handling of newly harvested corn, with directions for field selection and for individual plant tests as a means of improving the corn crop.

**Manufacturing tests of the official cotton standards for grade, W. S. DEAN and F. TAYLOR** (*U. S. Dept. Agr. Bul.* 591 (1917), pp. 27, figs. 11).—This describes spinning and weaving tests conducted during 1916 in representative mills at Fall River, Mass., and in the textile department of the North Carolina College, and bleaching tests made in Fall River and in the New Bedford (Mass.) Textile School to determine the relative intrinsic values of cotton of the grades of middling fair, good middling, middling, low middling, and good ordinary of the official cotton standards of the United States. The chief factors considered were the percentage of waste, the tensile strength of the yarn, the bleaching properties of the yarn and cloth, the moisture content, and other manufacturing properties of the cotton. The cotton employed was from the 1914 crop purchased during May and June of 1915 from the following zones or sections of the cotton belt: Piedmont Plateau, Atlantic Coastal Plains, eastern Gulf Coastal Plains, western Gulf Coastal Plains, and western Prairie Lands and Plateau.

Considerable tabulated data are presented and discussed and the results illustrated by graphs.

In addition to the above a comparison was made of results of spinning tests of the old permissive cotton grades with the present official cotton standards in tests conducted in a representative mill at Danville, Va., in 1913 on cotton from the 1912 crop.

The results of the spinning tests are summarized graphically and conclusions relative to the other observations as follows:

"The results of the moisture determinations emphasize the need of a more exact knowledge of the moisture content of cotton in the various stages of handling and marketing it and of maintaining proper artificial atmospheric conditions while it is in the course of manufacture.

"Tensile-strength tests were made of yarn which had been spun with the use of several twist constants [twists per inch divided by square root of number of yarns]. It was found that the constant of 4.75 which is generally considered standard for upland cottons was excessive. . . .

"The bleaching tests . . . showed that when the goods made from each grade were bleached under identical conditions middling fair and good middling were practically identical in color. The goods made from middling did not produce quite as pure a white as middling fair and good middling, but for commercial purposes gave satisfactory results. The goods made from low middling gave a slightly slaty color when closely compared with the other grades, while the goods made from good ordinary were easily distinguished by a slaty, bluish cast when compared with the goods made from middling cotton or that of a better grade. The lower grades might have been bleached more satisfactorily if in some of the processes the factors of time, concentration, and temperature had been altered.

"A comparison of the waste and tensile strength of the old permissive cotton grades . . . with the results of tests made on the present official cotton standards . . . shows that the changes made in the revision of the old permissive grades did not change the percentages of waste in the corresponding grades, but involved principally the factor of color and affected chiefly the lower grades.

"The tests based on the official cotton standards of the United States show that after making allowances for the losses due to the cleaning processes there is comparatively little difference between the grades above and those below middling in the price paid by the manufacturer for each pound of the usable cotton obtained from bales of the different grades, but that there is a difference in the intrinsic value per pound of the manufactured product. Accordingly, on the basis of quotations and values at the time of the tests, the inducement in the price paid to the farmer for the production of high-grade cotton was not commensurate with the greater value to the manufacturer of the product derived from such cotton."

Pollination and cross-fertilization in the juar plant (*Andropogon sorghum*), R. J. D. GRAHAM (*Mem. Dept. Agr. India, Bot. Ser.*, 8 (1916), No. 4, pp. 291-296, pls. 2).—Pollination and cross-fertilization studies with *A. sorghum*, made on the Nagpur (India) farm from 1908 to 1914, inclusive, are reported. The plants are said to be protogynous, the flowers being normally pollinated from higher flowers of the same panicle. Though typically anemophilous, the flowers were visited by insects, chiefly bees, at certain seasons. This condition probably led to natural cross-pollination, depending on the structure of the panicle, being greater in the loose forms than in the more compact ones.

Flowering occurred in a fairly regular order, the majority opening between 2 and 4 a. m., though stray flowers opened before and after, depending upon atmospheric conditions. The whole process from the time of the opening of the

glumes until the anthers assumed a pendent position occupied an average of 10 minutes, although it occasionally required only 8 minutes, while instances were recorded where 30 minutes were required to complete the process. The flowers opened only once, the glumes remaining open 2 to 3 hours. The stigmas remained outside and appeared quite fresh for 24 hours after the glumes had closed. The length of time required for the whole panicle to complete flowering varied with the size of the inflorescence and the number of flowers, but averaged about 7 days.

Cross-pollination between the flowers of the same panicle was the rule, the pollen from the higher and earlier-opening flowers falling on the stigmas of the lower and later flowers. Cross-pollination by foreign pollen can occur only in the first flowers to open and possibly in those late-opening flowers whose anthers do not dehisce. Self-pollination can occur only where the stigma remains surrounded by anthers which do not fall out.

The relative frequency of foreign pollination was found to be 6 per cent in a loose type of panicle with short glumes and only 0.6 per cent in a compact type of panicle. In Tharthur there was 20 per cent foreign pollination. Ball reported 50 per cent as the maximum.

A number of artificial cross-pollinations were made in a study of grain and glume characters. The grain is said to be either red, white, or yellow, while the glumes vary in length in comparison with the grain, from the commoner type which is shorter than the grain to the less common type which is much longer and completely conceals the grain. This latter type, so far as observed, was always associated with a loose type of panicle. In the grain, red and yellow and red and white behave as simple allelomorphs, red being dominant in both cases. Likewise, yellow and white may behave as simple allelomorphs, or the heterozygote may be red, behaving as a dihybrid with a 9:3:4 ratio for red, yellow, and white, respectively. The simplest explanation is deemed to be that certain white-grained plants were undeveloped reds, requiring the presence of yellow to cause the red color to develop. The long and short glume characters behave as simple allelomorphs.

Variety study of the Irish potato, W. H. Wicks (*Arkansas Sta. Bul.* 137 (1917), pp. 3-32, figs. 24).—This bulletin reports the results of extensive tests conducted at Fayetteville from 1915 to 1917, inclusive, at Van Buren during 1916 and 1917, and at Springdale in 1917, together with storage tests and brief notes on approved methods of potato growing and on the production of a second or fall crop in the State. A classification as to season and color has been made of the varieties employed in the test based on the scheme of classification suggested by Stuart (*E. S. R.*, 32, p. 830). Bliss Triumph, the principal commercial variety of the State, was used as a standard for comparison.

At Fayetteville 62 varieties showed higher average yields than Bliss Triumph, Irish Cobbler being first with 187.16 bu. of marketable tubers per acre, as compared with 70.38 bu. for Bliss Triumph. For the July 15 digging, 6 red and 16 pink varieties gave a higher average yield than the standard variety, while for the June 16 digging Irish Cobbler, Dussex Early Queen, and Early Six Weeks were the only varieties to exceed the State average, 71 bu. per acre.

At Van Buren 17 varieties exceeded the standard, Burpee Extra Early being the best with an average yield of 104.23 bu. of marketable tubers per acre as compared with 69.64 bu. for Bliss Triumph.

The highest yield at Springdale was obtained from White Mammoth, amounting to 152.92 bu. per acre on old land. Bliss Triumph gave a yield of 81.74 bu. on old land. Potatoes grown on old land gave much higher yields in every case than those grown on new land.

A test of varieties propagated from home-grown seed stored in an ordinary farm cellar during 1916 and 1917 at Fayetteville resulted in average yields for the leading varieties of 83.8, 82.29, and 80.47 bu. of marketable tubers per acre for Rural New Yorker No. 2, American Wonder, and Prosperity, respectively. The average loss from decay of these varieties amounted to 53, 42, and 5 per cent, respectively, and varied from 1.5 per cent for Manistee and Norcross to 76 per cent for Quick Crop for all the varieties tested. Bliss Triumph sustained a loss of 25 per cent. Digging dates found most satisfactory for successful storage were from July 1 to 15 in the Ozark region and from June 1 to 10 in the Arkansas River region.

Seed potatoes from the first crop to be used for fall planting were stored in the ground, in sand and mulch, and dry straw mulch, and in cellar, shed, and deep pit at Fayetteville, and in the ground, shed, and cellar at Van Buren. A comparative test in refrigeration was conducted at Eldorado. Ground storage resulted in considerable loss of seed from decay, while practically no loss was sustained from the other methods. The stand of plants from seed stored in sand and mulch, and in the ground at Fayetteville was 33 per cent greater than that from seed stored in other ways, and at Van Buren 50 per cent greater for seed stored in the ground.

The fall crop of Irish potatoes, W. H. WICKS (*Arkansas Sta. Circ. 30 [1917], pp. 4*).—This briefly outlines methods for growing a second crop of potatoes in Arkansas, and recommends varieties adapted to conditions in the State.

Sugar-cane experiments in the Leeward Islands, 1915-16, H. A. TEMPEANY et al. (*Imp. Dept. Agr. West Indies, Sugar-Cane Expts. Leeward Isl., 1915-16, pt. 1-2, pp. 76, pl. 1*).—Variety and fertilizer trials with sugar cane conducted in Antigua, St. Kitts, and Nevis in 1915-16 are reported as in previous years (*E. S. R., 35, p. 443*).

In the variety tests at Antigua, the five leading plant canes and their yields per acre were as follows: B. 6308, 32 tons of cane and 5,600 lbs. of sucrose; B. 4206, 32.2 tons of cane and 5,160 lbs. of sucrose; B. 1528, 27.8 tons of cane and 4,730 lbs. of sucrose; B. 6388, 25.8 tons of cane and 4,710 lbs. of sucrose; and B. 3922, 25.4 tons of cane and 4,540 lbs. of sucrose. The lowest yield was secured from B. 1753 with 15.2 tons of cane and 2,020 lbs. of sucrose. Of 13 varieties which have been under experimental cultivation for the past 15 years, Sealy Seedling has given the highest mean yield of sucrose, 6,450 lbs. per acre, with B. 208 second with 6,270 lbs., and B. 156 third with 6,150 lbs. The highest yield with ratoon canes for the year was obtained from B. 3747 with 28.5 tons of cane and 4,630 lbs. of sucrose, with B. 3922 second with 26.0 tons of cane and 4,500 lbs. of sucrose. Sealy Seedling, with an average yield of 3,680 lbs. of sucrose per acre, was first of 12 varieties of ratoon canes tested for the past 15 years, and B. 156 second with 3,560 lbs. The lowest yield with ratoon canes for the 1915-16 season was from A. 5, 14.3 tons of cane and 2,040 lbs. of sucrose.

At St. Kitts the five leading plant cane varieties were D. 109 with 36.3 tons of cane and 8,000 lbs. of sucrose, D. 216 with 36.6 tons of cane and 7,930 lbs. of sucrose, B. 4506 with 30 tons of cane and 7,670 lbs. of sucrose, B. 254 with 32.2 tons of cane and 7,620 lbs. of sucrose, and White Transparent with 33.1 tons of cane and 7,540 lbs. of sucrose. The lowest yield was secured from B. 1753 with 20.4 tons of cane and 3,870 lbs. of sucrose. The highest average yield for all seasons was secured from D. 216, 7,930 lbs. of sucrose for one season, with B. 208 second with an average of 7,620 lbs. of sucrose for 16 seasons, and D. 109 third with 7,400 lbs. of sucrose for 11 seasons. In tests with ratoon canes for 1915-16, A. 2 was first with 35 tons of cane and 7,660



lbs. of sucrose, and D. 109 second with 23.2 tons of cane and 6,470 lbs. of sucrose. B. 8289 was lowest with 16.9 tons of cane and 3,660 lbs. of sucrose. The highest average yield of ratoon canes for all seasons was obtained from A. 2 with 5,690 lbs. of sucrose for two seasons. B. 1753 was second with 5,600 lbs. for eight seasons, and B. 208 third with 5,560 lbs. for 15 seasons.

Tests with plant canes only are reported for Nevis, D. 216 being first with 41.9 tons of cane and 8,880 lbs. of sucrose, and D. 1111 second with 40.3 tons of cane and 7,690 lbs. of sucrose. B. 147 was lowest with 24 tons of cane and 4,700 lbs. of sucrose. The highest average yield for all seasons was obtained from D. 216, 8,880 lbs. of sucrose for one season, with D. 1111 second with 6,550 lbs. for two seasons.

Applications of 20 tons of pen manure apparently increased the yield of cane 5.5 tons per acre, while corresponding applications of commercial fertilizers gave exceptionally good returns, due to the favorable climatic conditions which prevailed during the growing season of 1915-16. The highest increase in the fertilizer tests, 11.2 tons of cane per acre, was secured from an application of 80 lbs. of phosphoric acid as basic slag, in addition to 60 lbs. of nitrogen as sulphate of ammonia and 60 lbs. of potash as sulphate of potash. An increase of 10.2 tons followed an application of 60 lbs. of phosphoric acid as acid phosphate in conjunction with nitrogen and potash. An application of 24 lbs. of potash in conjunction with phosphorus and nitrogen showed an increase of 8 tons, while a 40-lb. application showed an increase of only 7.4 tons. Sixty-lb. applications of nitrogen as sulphate of ammonia and nitrate of soda showed increases of 7.3 and 7 tons of cane, respectively.

The three-year-average results, 1913 to 1916, indicate that nitrogen is the most essential element required for conditions in the Leeward Islands. The phosphates were practically without effect, while appreciable increases were obtained from potash if the latter was applied with some nitrogenous material. The average increase in yield from a 20-ton application of pen manure was 5.3 tons. With 60-lb. applications of nitrogen as sulphate of ammonia and nitrate of soda the average increases were 5.2 and 5.1 tons, respectively.

Application of 200 and 400 gal. of molasses per acre showed average increases of 3 and 3.7 tons of cane per acre, respectively.

The results of the permanent manurial experiments at La Guérîte, St. Kitts, for the season 1915-16, are reported, but no conclusions drawn. The highest increase in yield, 8.9 tons of cane, was secured from the plot receiving pen manure alone.

The effect of sodium nitrate applied at different stages of growth on the yield, composition, and quality of wheat, J. DAVIDSON and J. A. LEClerc (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 4, pp. 145-154).—From the work of LeClerc and Leavitt (*E. S. R.*, 22, p. 730), Shaw and Walters (*E. S. R.*, 23, p. 133), and LeClerc and Yoder (*E. S. R.*, 30, p. 440), it was concluded that the principal factor causing variations in the nitrogen content of wheat was climate. The investigations here reported were undertaken to determine whether climate was responsible for variations in the available nitrates at different stages of growth.

Sodium nitrate was applied at the rate of 320 lbs. per acre at the time when the crop was about 2 in. high, at the time of heading, and at the milk stage. To assure the availability of the nitrate at a particular stage of growth it was applied in solution, the concentration being 1:100 in all cases. Parallel plots were prepared to which the solid nitrate was applied to check the solution method. All plots received the same amount of water at each of the three stages of growth, and were checked by a series of plots receiving no water.

Additional series of plats received sodium nitrate and potassium chlorid and potassium chlorid alone in order to compare the results obtained under these conditions with those obtained by Headden (E. S. R., 33, p. 41). The treatment of the individual plats for each stage of growth is outlined. The experiments were conducted in 1916 on the Kentucky Experiment Station farm, at Lexington, Ky. The results obtained are reported in tabular form, showing the yield and percentage of grain, percentage of yellowberry and protein content, and the weight per bushel and weight per 1,000 kernels of wheat grown under the various treatments. The conclusions arrived at may be summarized as follows:

The presence of sodium nitrate in the soil at the early stages of growth stimulated vegetative growth and gave greater yields. The nitrate in the soil at the time of heading gave a better quality of grain with regard to color and protein content, but the vegetative growth was not in the least affected. The nitrate in the soil at the milk stage had no effect on the yield, quality, or protein content of the grain. Identical results were obtained from the plats receiving nitrate in solution and those receiving it in solid form, except that the yields from plats receiving the fertilizer at the first stage were higher in the former case than in the latter. This difference was attributed to a better distribution of the fertilizer when applied in solution.

Potassium chlorid did not affect vegetative growth nor the composition of the grain, but did seem to increase the amount of yellowberry when used alone, agreeing in this respect with results obtained by Headden, as noted above and in more recent investigations (E. S. R., 37, p. 38). No consistent variation was observed in weight per 1,000 kernels or in weight per bushel. Although these experiments are believed to have established a definite correlation between percentage of nitrogen and yellowberry, they did not indicate any such correlation between protein and weight per 1,000 kernels, a correlation found in previous work of LeClerc and his associates. The authors conclude that this may be due to the change from the hard winter wheat variety formerly used to the soft winter wheat variety used in these experiments, or that the causes affecting protein content and color of grain and those affecting the weight per 1,000 kernels are not the same.

The quality of western-grown spring wheat, C. H. BAILEY (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 4, pp. 155-161).—Data obtained from milling and baking tests made at the Minnesota Grain Inspection Department Laboratory with Washington, Idaho, and Montana wheats of the 1916 crop and showing the percentage of crude protein in each are reported in tabular form and discussed. The samples analyzed included western hard spring wheats, western hard winter wheats, western soft red wheats, Early Baart, Pacific Bluestem, and other western white wheats.

The quantity of Marquis wheat produced in the Pacific Northwest and Montana during 1916 was much larger than usual, due to an increased acreage in certain sections and to the reseedling of winterkilled winter wheat fields in Montana. Marquis grown at Pullman, Wash., was higher in protein content and baking strength than any of the common varieties analyzed, while samples of this variety grown at lower altitudes were, in general, materially lower in baking value and percentage of crude protein than those grown at higher altitudes, the difference being attributed to the shorter growing season under the latter conditions. Marquis grown under dry-farming conditions in Montana was of good milling and baking quality and somewhat superior in these respects to Turkey winter wheat grown in the same districts.

Early Baart samples from the Big Bend district near Lind, Wash., were higher in percentage of crude protein and were nearly as satisfactory from the

baking standpoint as the average spring wheats produced east of the Divide and in the northern Great Plains district.

The soft red and white wheats, such as Jones Winter Fife, Little Club, Red Russian, and Fortyfold, are deemed generally inferior in baking qualities to Marquis and Turkey grown in the same sections.

Winter wheat in the Great Plains area: Relation of cultural methods to production, E. C. CHILCOTT, J. S. COLZ, and J. B. KUSKA (*U. S. Dept. Agr. Bul. 595 (1917), pp. 35, fig. 1*).—This presents a study of the yields and of the comparative cost of production, with the resulting profit or loss, of winter wheat grown under various methods of seed-bed preparation at 13 field stations in the Great Plains region, made in such a way as to show the effect of cropping and cultivation in only the year preceding its growth. The investigations cover an aggregate of 75 station years, embodying the data from 1,137 plot years. The area studied included the western portions of North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas and the eastern portions of Montana, Wyoming, Colorado, and New Mexico. The results obtained at each field station are discussed separately, and tabulated data presented giving the yield and cost of production for such cultural treatments as early fall plowing, late fall plowing, subsoiling, listing, disking, green manuring, summer tillage, and previous cropping. A brief description of the soil, with special reference to its depth and water-holding capacity, accompanies the discussion of each field station.

The results obtained in these investigations were in a measure comparable with those found in similar studies with spring wheat, already noted (*E. S. R.*, 33, p. 137), and led to the general conclusion that "in the average of all methods by which the crops are grown winter wheat has a marked advantage over spring wheat, both in yields and profits per acre, at North Platte [Nebr.], Akron [Colo.], and Hays, [Kans.], in the central portion of the Great Plains and at Huntley, Mont. At the other stations, where either crop can be grown profitably, the average differences in favor of either are not great enough to be conclusive from the evidence at hand.

It was further shown that in the case of winter wheat "the average difference in yields between early (deep) and late (shallow) fall plowing is 1 bu. per acre. At most stations the difference is small, while at others the advantage of one over the other depends on the season. At Scottsbluff [Nebr.], North Platte, Hays, and Amarillo [Tex.], the differences are rather consistently in favor of early plowing, and this method is more profitable at these stations. At the other stations late plowing has netted larger returns.

"Furrowing with a lister after harvest and leveling the ridges preparatory to seeding have resulted in an average increase of 0.9 bu. over early plowing and 2.2 bu. over late plowing. As it is a cheaper method of preparation than plowing, it has consequently been more profitable. At Hays and Amarillo it has been the most profitable method.

"Subsoiling has increased the yields over plowing without subsoiling at 5 of the 10 stations at which it has been studied. At these stations it has been more profitable than ordinary plowing. At the other stations it has been the least profitable of the continuous-cropping methods. It has not shown any value in overcoming drought.

"Disked corn ground has given consistently high yields. This, together with the low cost of preparation, has resulted in this method showing the highest average net returns of any of the methods at all of the 11 stations where it has been tried except at Huntley and Amarillo. These profits are based on the assumption that the corn crop was so utilized as to pay for the cost of producing it.

- Summer tillage has given the highest average yields of any method under trial at 11 of the 13 stations. However, on account of its high cost, due to extra labor and alternate-year cropping, it has not netted the largest returns except at Huntley.

- Green manuring is the most expensive method under investigation. It has given the smallest net returns of any of the methods at all of the stations except Huntley, where the profit from it is slightly greater than from either fall plowing or subsoiling.

- In comparison with spring wheat, winter wheat shows a greater response to summer tillage and is the more profitable crop to grow on land so prepared. This appears to be true at all stations studied except possibly Garden City [Kans.], Dalhart [Tex.], and Tucumcari [N. Mex.], where large average losses attend the growth of either crop."

Extending the area of irrigated wheat in California for 1918, F. ADAMS (*California Sta. Circ. 182* (1917), pp. 4).—This briefly outlines the possibilities of increased wheat production in the Sacramento, San Joaquin, and Imperial Valleys of California by a judicious use of available irrigation facilities.

More wheat (*Arkansas Sta. Circ. 51* [1917], pp. 4).—A brief, practical outline on wheat growing in Arkansas.

Agricultural seed: Concerning the germination of seed, C. P. BURNS, A. K. PERKINS, and L. H. FLINT (*Vermont Sta. Bul. 205* (1917), pp. 3-48, pls. 4).—This reports the results of purity and germination tests of 365 official samples of agricultural seed collected throughout the State during May, 1917, together with a discussion of the Vermont agricultural seed law. Approximately one-twelfth of the samples analyzed were not guaranteed as required by law and about 2 per cent of those that were guaranteed were found to be seriously deficient in purity.

The importance of the home determination of the viability of seed is emphasized and simple devices for determining the germinability of seed briefly described.

Seed Reporter (*U. S. Dept. Agr., Seed Rptr., 1* (1917), No. 2, pp. 8).—This number contains statistical information and tabular data on the supply of clover and alfalfa seed held by large dealers November 15, 1917, and on the preliminary garden seed survey of November 1.

Market conditions and seed movements are noted as follows: Sorghum seed and German millet in Kansas and Missouri; cowpeas in the cotton States; sweet clover, Sudan grass, and alfalfa in Kansas; clover and timothy at Toledo, Chicago, and Milwaukee; Kentucky bluegrass in Missouri and Iowa; and soy beans in Mississippi and Louisiana. The seed corn situation throughout the corn belt is briefly reviewed and the seed sweet corn situation noted. Thresher reports of clover and timothy in Michigan are given, and tabular data presented on imports of forage plant seed permitted entry into the United States during November.

Special articles include Clover Seed Production, by A. J. Pieters, and The Lespedeza Seed Production and Movement for 1917, by H. S. Coe. The necessity of a reserve supply of cottonseed for 1918 plantings is emphasized. Suggestions relating to the labeling of field crop seeds, as adopted by the U. S. Department of Agriculture and representatives of the seed trade, and later approved by the seed trade associations, provide that lots of 10 lbs., or over, of field crop seeds shall be so labeled as to show the name of the seedsman, the kind of seed, the viability of the seed, and the origin of the seed.

## HORTICULTURE.

The winter storage of roots, P. H. ALDRICH (*Vermont Sta. Bul. 203 (1917), pp. 3-9*).—Tabular results are given of preliminary studies made with carrots, beets, and parsnips largely to determine the influence of temperature variations during storage, of media, and of disinfectants upon such preservation, as well as of the nature of the modifications occurring in the vegetable structures during storage. The storage period in all cases lasted from November 12 until May 28.

The results of the temperature tests indicate in general that these vegetables should not be stored at living-room temperatures, that beets will store well under cellar conditions, and that carrots and parsnips will keep better under cold-storage conditions.

The media tests indicate that it is not necessary to pack beets in any substance in order to keep them well, but that carrots and parsnips keep somewhat better when packed in alternate layers of sand. Sawdust, newspaper wrappings, and garden soil were less satisfactory as packing media.

Immersing the vegetables for ten minutes in Bordeaux (5:5:10) appeared to improve the keeping quality of carrots and parsnips when stored in the cellar, but was detrimental to beets. A 3-minute immersion in mercuric chloride (1 tablet to 1 pint) gave decidedly poor results. Immersing the vegetables in paraffin did not injure the keeping quality of beets but gave very poor results with carrots and parsnips.

Moisture determinations were made before and after storage. In general, it may be said that the roots packed in dry media lost in weight; that those packed in moist media gained in weight; that those placed in cold storage gained; and that those treated with disinfectants lost in weight.

Relative to the edible qualities of the vegetables after storage carrots placed in cold storage, packed in dry sand and dry sawdust, as well as those immersed in Bordeaux, were tender and well flavored. The best beets were those packed in moist sand, moist sawdust, or garden soil. The best parsnips were those placed in cold storage, packed in moist sand, moist sawdust, dry sawdust, as well as those immersed in Bordeaux and those immersed in paraffin.

Careful comparisons of the tissues of the three vegetables under study made in the fall and again in the spring after 6.5 months storage led the author to conclude that there is an increase in the amount of fibrous tissue following winter storage in beets, but not in carrots and parsnips. It is thought that the apparent increased toughness and stringiness of the latter in the spring may be due to the thickened trachea tubes, although the correctness of this surmise was not demonstrated. In the case of the beet, however, it was quite clear that increases in fiber tissue occurred to a greater extent in the lots kept under dry than in those kept under moist conditions. This development seemed to be made at the expense of the surrounding companion and parenchyma cells.

Greenhouse-grown radishes were stored on March 12 in cold storage wrapped in cheesecloth, in the cellar, and in the living room. Lots were stored with the tops on and with the tops off. The radishes were preserved in a fairly edible condition under cold storage for about 3 months. Radishes wrapped in cheesecloth and placed in cellar storage were preserved for about 1 month. Those placed in water were preserved for about 3 weeks. Radishes placed in water in the living room were preserved for about 10 days. In all cases the lots on which the tops were left kept better than those which had been topped. There was no noticeable benefit in using distilled water in place of tap water.

War vegetable gardening and the home storage of vegetables (*Washington, D. C.: Nat. War Gard. Com., 1918, pp. 32, figs. 30*).—A compilation on home

pickling and home storage of vegetables, prepared under the direction of the National War Garden Commission.

**The forcing of plants by means of warm water immersions.** W. G. BODINE (*Vermont Sta. Bul.* 203 (1917), pp. 9, 10).—A brief summary of the results secured in a test of the warm water method of forcing plants (*E. S. R.*, 32, p. 437).

\* Twigs of wild grape, elm, apple, basswood, cottonwood, and a species of *Rubus* were gathered on February 10, thawed, and placed for from 4 to 8 hours in water, some at 36° C. (96.8° F.) and some at 7°, and then placed in the greenhouse. The first leaves were observed on the twigs immersed in warm water from 5 to 15 days sooner than they were observed on the twigs immersed in cold water, with all the species other than the apple. For some un-discovered reason the growth of the apple twigs seemed retarded.

Stringless green pod bean seed was soaked for lengths of time ranging from 15 to 120 minutes in water which varied in temperature from 10 to 22° for the colder water and 37 to 45° for the warmer water. The trials were made in the late fall and early spring. No gains were secured in the earliness or profuseness of growth as a result of soaking either in cold or warm water as compared with untreated seed. Similar trials made with peas gave the same results. Radishes grew a smaller top but a better root when the seed was immersed in water at from 38 to 41° for 45 minutes than they did when the seed was either soaked in cold water or left untreated. Corn and oats treated in the winter months grew better and somewhat larger crops were secured when the seed was soaked at from 36 to 41° for from 4 to 5 hours than when left untreated or when soaked in cold water. No material response followed the warm water treatment of corn and oats in the spring or summer.

The author concludes that temperatures from 30 to 36° are best adapted to experimental needs in most cases, and that a soaking of from 7 to 12 hours for twigs and shrubby plants and of from 2 to 5 hours for seeds seems optimum. Longer exposures are deemed inadvisable. Late spring immersions proved relatively ineffective. The growth stimulus appears to be due to warmth rather than to absorption of water. Seeds soaked in warm water absorb more water than those soaked in cold water, thus softening the seed coats and inducing favorable results.

**Colors in vegetable fruits.** B. D. HALSTED (*Jour. Heredity*, 9 (1918), No. 1, pp. 18-23).—A discussion of color inheritance in fruits of the tomato, pepper, and eggplant, based upon the author's long-continued breeding investigations at the New Jersey Experiment Stations (*E. S. R.*, 36, p. 838).

**Horticultural investigations at the Umatilla experiment farm, Oreg., in 1915 and 1916.** R. W. ALLEN (*U. S. Dept. Agr., Bur. Plant Indus., Work Umatilla Expt. Farm, 1915-16*, pp. 12-14, 27-32).—A brief progress report is given on an apple-orchard cover-crop experiment in which winter crops of vetch and rye, used as green manures, are being compared with alfalfa grown between the tree rows. Thus far no conclusive data have been secured in the experiment.

An experiment was started to determine the comparative success of fruit trees planted on raw land and on alfalfa sod. The results for two seasons, although not conclusive, indicate that better success can be had by starting the trees on alfalfa sod than on raw land, but the growth of the trees does not indicate that two years' growth of alfalfa, followed by plowing a crop of it in, improves the land sufficiently to produce trees of desirable vigor.

Notes are given on the condition of a number of varieties of tree fruits, grapes, and cane fruits under trial at the farm.

[Horticultural experiments at the San Antonio experiment farm in 1916]. C. R. LETTEK (*U. S. Dept. Agr., Bur. Plant Indus., Work San Antonio Exp. Farm, 1916, pp. 16-19, fig. 1*).—This comprises brief notes on fruits, nuts, and ornamentals being tested at the station farm.

The handling and precooling of Florida lettuce and celery, H. J. RAMSEY and E. L. MARKELL (*U. S. Dept. Agr. Bul. 601 (1917), pp. 28, figs. 19*).—During the seasons of 1913-14 and 1914-15 investigations were conducted by the Bureau of Plant Industry for the purpose of ascertaining the causes of losses by decay in lettuce and celery shipped from Florida, and to determine practical means of reducing them. In the work with lettuce precooling and holding experiments were conducted at the shipping point and the lettuce was examined at the market, New York City, upon arrival and a few days after arrival. Precooling experiments with celery were conducted at the shipping point and storage experiments after reaching the market in New York City. The results secured from these experiments are presented in a series of tables and diagrams and fully discussed.

The decay in lettuce in transit was found to be due largely to lettuce drop, a disease which appears to enter the head mainly through the lower leaves. The experiments have shown that much of this decay can be avoided by cutting the heads at a point just above these leaves and discarding the head entirely if very many of the leaves are diseased. Lettuce in cars that were precooled at the shipping point to a temperature of about 40° F. developed considerably less decay in transit than that shipped in nonprecooled cars. With careful cutting and precooling the lettuce reached its destination in almost perfect condition and held up much better on the market than lettuce handled in the usual manner.

Precooled celery arrived on the market in a uniformly fresh condition, with the leaves on the top tier nearly as green as those on the bottom. Nonprecooled celery showed very yellow leaves in the top tier, thus discounting the value of the entire load. Precooled celery was stored successfully for four weeks with little decay, whereas nonprecooled celery developed considerable decay during the same storage period. The work indicates that celery from the lower part of a nonprecooled car can be stored for a short period, but during warm weather that on the top tier should be disposed of as soon as it reaches the market. The cost of precooling and initial icing of a car of celery was less than the usual charge for full refrigeration in transit. In warm weather one icing in transit may be required, thus increasing the cost of precooling to about the usual full refrigeration charges.

Concerning quality in celery, J. B. NORTON (*Vermont Sta. Bul. 203 (1917), pp. 10-12*).—A summary of experiments dealing with growth and quality in celery.

In a series of experimental trials wherein plants were grown in water or were given water in amounts ranging downward from 187 cc. to 1 cc. daily, there was no height growth or even shrinkage in height when 15 cc. or less was supplied daily, and increasing height growth when from 31 to 187 cc. was given daily. Celery plants treated with 0.25, 0.5, and 0.75 gm. of nitrate of soda, respectively, showed increased height growth for a period of 30 days roughly proportional to the amounts of fertilizer used. Similar results were obtained by the use of artificial mixtures of half sand and half humus-rich soil and of one-third sand and two-thirds humus-rich soil.

Several plants were grown either in full light, in half light, or in darkness. Intense light hindered growth and lack of light caused an abnormal etiolated growth. The full-lighted crop was dwarfed, stringy, and tough. The half-

lighted crop was of good quality, and the no-light crop was long-stemmed, watery, and subject to disease attack. Celery grown at 80° F. was shorter and far more leafy than that grown at 60° but its quality was not injuriously affected.

It is pointed out that blanching, if properly done, tends to develop a nutty flavor; if improperly done, a bitter flavor. In either case the chlorophyll is profoundly modified or destroyed. Reference is made to experiments conducted at the Maryland Station in which it was shown that pithiness, which is characterized by lack of parenchyma, is due in the self-blanching varieties to heredity, to the propagation of an undesirable strain, or to reversion, but that in other forms of celery it is quite as likely to be due to unfavorable cultural conditions. Careful seed selection, it is believed, should to a large degree obviate this difficulty.

**Breeding sweet corn resistant to the corn earworm,** G. N. COLLINS and J. H. KAMPTON (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 11, pp. 549-572*).—Observations made by O. F. Cook on a variety of field corn growing near Brownsville, Tex., indicated that the greater immunity of southern varieties of field corn to depredations of the corn earworm may be due to the greater development of husks in these varieties as compared with northern varieties. Breeding investigations were started in 1912 by J. H. Kinsler with the idea that the special susceptibility of sweet corn varieties to attacks of the corn earworm may not be due to the character of the seeds alone. Crosses were made between three commercial varieties of sweet corn, Stowell Evergreen, Early Evergreen, and Early Cory, and two varieties of field corn, Brownsville and Marquinto. The work of breeding and selection was continued by the authors, and a biometric study was made of characters believed to be associated with corn resistance. Earworm resistance was tested in 1915 near San Diego, Cal., and in 1916 near Washington, D. C. The results of the investigation are here tabulated and discussed in detail.

The progeny of these crosses have been found to be much less subject to injury from the corn earworm than commercial sweet varieties, and the data secured indicate that the factors concerned in immunity are inherited, and thus capable of improvement. Of the characters measured, prolongation, or the extent to which the husks exceed the ear, was found to be the most closely correlated with low damage. Thickness of the husk covering was associated with low damage to some extent, but only 5 per cent of the larvae that reach the ear bore through the husk. The occurrence of leaves on the husks appeared to attract the moths or, at least, to afford a location for the eggs. Certain recorded differences between the inter and intraprogeny regression are believed to indicate that the protection is in part due to other characters correlated with husk prolongation and not included in those measured. It was found that in the more immune progenies both the number of larvae and the damage per larva were low. It is suggested that at least part of the immunity may be due to the presence of some volatile substance distasteful alike to the moth and larvae. This was not noticeable in the ear, for when gathered at the proper time the immune strains were pronounced by a number of different observers to be fully as sweet as the parent sweet varieties.

"From the experiments here reported it appears that by increasing the length and thickness of the husk covering and reducing the husk leaves varieties of sweet corn can be produced in which damage from the corn earworm is materially lessened. No difficulty was experienced in securing by hybridization and selection the desired plant characters in combination with the seed characters of sweet corn."



Experimental projects of the division of pomology, University of California, W. L. HOWARD (*Mo. Bul. Com. Hort. Cal.*, 7 (1918), No. 1-2, pp. 62-84).—A summarized statement of projects being conducted at Davis, Berkeley, and elsewhere in California.

The science of fruit growing, V. BOGUX (*Rochester, N. Y.: Democrat and Chronicle Print*, 1917, pp. 37, pl. 1).—In this booklet the author draws a comparison between the life functions of plants and of animals and presents some views as to how fruit trees should be grown to conform to the laws of nature.

Apple breeding in Canada, W. T. MACCOUN (*Agr. Gaz. Canada*, 5 (1918), No. 2, pp. 126-128).—A brief summary of results secured from long-continued breeding investigations conducted at the Central Experimental Farm, Ottawa (E. S. R., 30, p. 742).

Citrus culture, P. GURRET-VAUQUELIN (*La Culture des Citrus. Paris: Augustin Challamel*, 1917, pp. 104, figs. 11).—A treatise on citrus, with special reference to the Mediterranean zone. The introductory chapter discusses the morphology of the genus. The succeeding chapters deal with species and varieties, culture, maladies, and insect remedies, citrus in the industries and in medicine, and summer citrus, such as lemons and limes.

[Coconuts and coffee] (*Proc. Agr. Conf. Malaya*, 1 (1917), pp. 64-74, 115-122, 163-170).—The following papers, with discussions, contributed to the First Agricultural Conference of Malaya, held at Kuala Lumpur, April 25-28, 1917, are here reported: The Diseases and Pests of the Coconut Palm, by R. M. Richards (pp. 64-74); Observations on Coconut Experiments, by G. E. Coombs and W. S. Cookson (pp. 115-122); and The Cultivation of Liberian Coffee, by R. W. Munro (pp. 163-170).

The grafted jujube of China, D. FAIRCHILD (*Jour. Heredity*, 9 (1918), No. 1, pp. 3-7, figs. 5).—An account of the Chinese jujubes that have been tested in recent years by the U. S. Department of Agriculture in various parts of the country. The author indicates regions in which seedling jujubes have been more or less successful and regions that are considered promising for testing the grafted forms.

Chrysanthemum varieties, A. D. SHAMEL (*Jour. Heredity*, 9 (1918), No. 2, pp. 81-84).—As further evidence of the origin of certain cultivated varieties of ornamental plants through bud variation (E. S. R., 37, pp. 145, 546) the author presents a partial list of chrysanthemum varieties reported by Cramer as originating from bud sports in his review of the known cases of bud variation (E. S. R., 20, p. 325).

Longevity in lily pollen, F. H. HORSFORD (*Jour. Heredity*, 9 (1918), No. 2, p. 90).—The author found that the pollen of early lily varieties may be preserved for two or three months in small envelopes for use in pollinating late varieties. Pollen of *Lilium auratum* was wrapped in two or three sheets of paraffin paper, kept in a warm, dry place, and successfully used the following spring in pollinating *L. martagon*.

A striking reproductive habit, A. A. HANSEN (*Jour. Heredity*, 9 (1918), No. 2, p. 85, fig. 1).—The production of aerial bulbs on stems of the Easter lily, *Lilium longiflorum crinitum*, is illustrated and discussed. As experimentally determined, these bulbs produce normal plants, devoid of aerial bulbs; hence it is concluded that the phenomenon is not due to inheritance.

Petalization in the Japanese quince, A. A. HANSEN (*Jour. Heredity*, 9 (1918), No. 1, pp. 15-17, figs. 2).—An illustrated discussion of the intergrading of petals and stamens as observed in the Japanese quince (*Cydonia japonica*), with special reference to the utilization of the flowers of this ornamental as illustrative material by teachers and others.

"Bog" gardening with native plants, N. TAYLOR (*Gard. Mag. [N. Y.]*, 26 (1917), No. 3, pp. 89-91, figs. 9).—A discussion of ornamental plants adapted to wet, undrained soils, including directions for making an artificial bog.

### FORESTRY.

The administration of the State forests in Hokushu, O. SHIMIDU (*Jour. Col. Agr. Tohoku Imp. Univ.*, 7 (1917), No. 7, pp. 415-449).—A historical sketch of forest activities on the island of Hokushu, Japan, including an account of the administration of the State forests.

Effects of grazing upon western yellow-pine reproduction in the National Forests of Arizona and New Mexico, R. R. HILL (*U. S. Dept. Agr. Bul.* 580 (1917), pp. 27, pls. 3, figs. 2).—This bulletin presents the results of a study to determine the character and extent of the damage to young growth of western yellow pine in the Southwest from the grazing of live stock, and to find out the best means of keeping such damage at a minimum while permitting the proper utilization of the range. Recommendations are given relative to the application of the results to range management in the Southwest.

Germination of pine seed, E. WINCK (*Skogsvårdsför. Tidskr.*, 15 (1917), No. 2, pp. 141-174, figs. 4).—The results are given of germination tests of pine seed secured from different localities in Sweden. Related germination was found to increase with the inclemency of the climate in the locality from which the seed originated.

The pine tree of north Sweden, N. SYLVÉN (*Skogsvårdsför. Tidskr.*, 14 (1916), No. 12, pp. 783-884, pl. 1, figs. 53).—A discussion of two kinds of Swedish pine, *Pinus lapponica* and *P. sylvestris*, with special reference to influence of locality on tree and seed characteristics.

[Rubber cultivation and rubber preparation] (*Proc. Agr. Conf. Malaya*, 1 (1917), pp. 3-35, 37-63, 96-114).—Under these general headings the following papers, with discussions, contributed to the First Agricultural Conference of Malaya, held at Kuala Lumpur, April 25-28, 1917, are here reported: Cultivation and Manuring, by A. P. N. Vesterdal (pp. 3-10); Cultivation, Drainage, and Manuring, by F. G. Spring (pp. 11-19); Thinning Out, by T. J. Cumming (pp. 20-22); Thinning Out, by E. W. King (pp. 23-28); Rubber Seed Selection, by A. H. Malet (pp. 29-32); Rubber Seed Selection, by J. McNicol (pp. 33-35); Clean Clearing, Pests, and Diseases, by W. R. Shelton-Agar (pp. 37-43); Diseases of the Leaves and Stem of *Hevea brasiliensis* in the Malay Peninsula, by R. M. Richards (pp. 44-54); Root Diseases of Hevea and Clean Clearing, by W. N. C. Belgrave (pp. 55-63); Rubber Manufacture and Factory Methods, by F. G. Souter (pp. 96-105); and The Preparation of Plantation Para Rubber, with Special Reference to Future Considerations, by B. J. Eaton (pp. 106-114).

On a new essence from *Blepharocalyx gigantea*, F. ZELADA (*Univ. Tucumán, Inform. Dept. Invest. Indus.*, 1917, pp. 5-13, figs. 3).—A histological and chemical study of the wood and leaves of this Argentine tree, which yields a turpentine-like essence.

Pulpwood consumption and wood pulp production, 1916, F. H. SMITH and R. K. HELPHENSTINE, JR. (*U. S. Dept. Agr., Forest Serv. [Pub.]*, [1917], pp. 30, figs. 5).—This comprises the results of a statistical survey of the pulpwood and wood pulp industries in 1916, conducted by the Forest Service in cooperation with the News-Print Manufacturers Association.

The total quantity of pulpwood used by 230 establishments reporting was 5,228,558 cords, an increase of 17 per cent over 1914, the last year for which similar statistics were compiled. The quantity of wood pulp produced in 1916 amounted to 3,271,310 tons, an increase of 13 per cent over 1914.

## DISEASES OF PLANTS.

The relation of some rusts to the physiology of their hosts, E. B. MATHE (Amer. Jour. Bot., 4 (1917), No. 4, pp. 179-220, pls. 2).—The work here outlined was carried on during 1914 to 1916 in order to obtain data regarding the factors which control the obligate condition for parasitism and to determine the sort of substances necessary to such parasitism.

It is stated that the optimum temperature for *Puccinia coronata* and *P. sorghi* is near 20° C. (68° F.) and the maximum for the latter is about 10° higher. *P. sorghi* is favored by moist soil and humid atmosphere, but it develops also on the host under dry conditions. Neither of these fungi appears to injure directly the cells of the area infected. The surrounding areas appear to suffer starvation owing to the withdrawal of the food material by the infected areas. Depriving the host of various nutritive substances reduces the quantity of rust. The fungus is not starved by deprivation of light, except as this reduces the carbohydrate supply of the host. Lack of carbon dioxide has the same effect as darkness in case of *P. sorghi*. Pure cultures of this fungus can be maintained upon sterile seedlings and upon pieces of *Zea mays* floated upon carbohydrate solutions, and it also develops and forms spores on seedlings or pieces of corn leaf in the dark when these are supplied with starch, cane sugar, dextrose, maltose, and dextrin; but it is not able to develop in the dark when the seedlings or leaves are exhausted of carbohydrates and when only mineral nutriment or water is supplied. *P. sorghi* is not able to utilize directly a supply of maltose, dextrose, cane sugar, asparagin, leucine, peptone with or without mineral salts, or decoctions of the host.

The obligate parasitism of the rusts is thought to be explainable by their requirement of some transitory or nascent organic products related to the carbohydrates which they obtain in the living host.

The origin and development of the galls produced by two cedar rust fungi, J. L. WEIMER (Amer. Jour. Bot., 4 (1917), No. 4, pp. 241-251, pls. 5, fig. 1).—The author states that the galls produced by *Gymnosporangium juniperi-virginiana* and *G. globosum* on *Juniperus virginiana* originate as modified leaves, the vascular systems of the galls being composed of the enlarged and modified leaf-trace bundles.

The genus *Citromyces*, G. POLLACCI (Atti Ist. Bot. R. Univ. Pavia, 2. ser., 16 (1916), pp. 121-136, pl. 1).—The author discusses several species of the genus *Citromyces* which he thinks should be placed in the genus *Penicillium*. He has renamed *C. pfefferianus*, which is technically described as *P. pfefferianum*.

Mycological notes, A. LENDNER (Bul. Soc. Bot. Genève, 2. ser., 8 (1916), No. 4-6, pp. 181-185, figs. 3).—Discussion is given of *Pestalozzia briardi* (said to be identical with *P. monochaetoides*), which is present but does little damage on grapevines, also of a fungus technically described as a new species (*Lophium chodati*) on *Pinus sylvestris*.

Diseases and injuries of cultivated plants during 1912 (Ber. Landw. Reichsanst. Intern., No. 38 (1916), pp. VIII+354).—This report deals with the weather in Germany during the year, with the influence of disease and injury on crops (particularly noting those considered as more important), and with the apparatus and materials employed against injurious agencies.

Grain smut in Java, C. J. J. VAN HALL (Teyssmannia, 28 (1917), No. 1, pp. 24-27).—Among the diseases which have already appeared on the grains now being tested out with a view to their cultivation in the Dutch East Indies are wheat smut (*Ustilago tritici*) and barley smut (*U. nuda*).

The prevention of bunt, G. P. DARNELL-SMITH (Agr. Gaz. N. S. Wales, 28 (1917), No. 3, pp. 185-189).—Tests reported during a series of years are said to

show that the best average results, considering both freedom from bunt and germinability, are obtained by dipping the seed grain into 1.5 per cent copper sulphate for 3 minutes and then for an equal period of time into limewater. This is considered the standard remedy to be employed for protection from bunt. Formalin lowered the germination percentage. Experiments under conditions of heavy infection of the check plots at Cowra in 1915 and 1916 and at Wagga in 1915 gave, however, better results from dry copper carbonate (2 oz. per bushel) than from the standard method above noted. The use of gaseous formaldehyde gave unsatisfactory results during its year of trial, and the tests are to be repeated with modifications.

**Pod blight of the Lima bean caused by *Diaporthe phaseolorum*, L. I. HARRIS** (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 10, pp. 473-504, pls. 2, figs. 11*).—An account is given of an investigation of pod blight of Lima beans, which was first reported in this country by the botanist of the New Jersey Station (*E. S. R.*, 4, p. 52).

The disease is characterized by circular brown spots on the leaves and large unsightly spots on the nearly mature pods and stems. As a result of a study of the disease and the literature pertaining to it, the author concludes that it is due to *D. phaseolorum*. In addition to its occurrence on the Lima bean, the fungus was found to fruit well on stems of *Melilotus alba*, rice, corn leaf, and other starch media. Dilute solutions of formaldehyde, copper sulphate, and mercuric chlorid proved toxic to the spores.

For the control of the pod blight, the author recommends the selection of clean seed which should be disinfected in mercuric chlorid, formalin, or copper sulphate. The plants in the field should be sprayed from the time they are 1 to 2 ft. tall sufficiently often to keep the foliage covered with a copper fungicide.

**Cucumber scab caused by *Cladosporium cucumerinum*, S. P. DOOLITTLE** (*Rept. Mich. Acad. Sci., 17 (1915), pp. 87-116*).—The injury associated with cucumber scab, which is said to have been very severe during the past two seasons in Michigan, Indiana, and Wisconsin, is due partly to the soft rots which gain access through the scab lesions. The author gives an account of a somewhat extended study of the disease, its distribution, effects, and control.

The chief difficulty in the control of this disease lies in the rapid growth of the cucumber plant and fruit and in the rapid development and spread of the fungus. Measures recommended include rotation, destruction of trash and weeds, drainage, drilling in rows of ample width, airing and sunning the vines after showers, and frequent spraying coordinated with the weather changes.

**Flax wilt: A study of the nature and inheritance of wilt resistance, W. H. THORPE** (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 11, pp. 573-606, pls. 3, figs. 8*).—In a contribution from the Wisconsin Experiment Station, the author gives the results of investigations carried on as to the nature and inheritance of wilt resistance. For the purpose of this study, flax was chosen on account of the ease with which it may be grown, its short growing season, the availability of resistant and susceptible strains, the ease with which the strains are crossed, etc. The wilt, which is due to *Fusarium lini*, was studied at great length.

The fungus was found to penetrate the flax plant through root hairs, young epidermal cells, stomata of seedlings, and perhaps through wounds, invading the tissues of susceptible plants and causing the wilt. No considerable clogging of vessels was observed, and the wilting is believed to be due to several factors, such as the destruction of the young active root system, which partly cuts off the food and water supply of the plant; use of the food and water

supply by the fungus; increased transpiration due to a rise in temperature; and the possible production of toxins which injure the host protoplasm.

As a result of the studies on resistance, it is believed that resistance is essentially of a chemical nature. Inheritance of resistance through hybridization in which susceptible and immune strains were crossed was studied, and resistance was found to be an inherited character which is apparently determined by multiple factors. Great difference was observed in the individuality of plants with respect to the resistant character, as shown by their offspring. The first generation from some crosses is entirely resistant, from some intermediate, and from others entirely susceptible. The degree of resistance appears to depend to a considerable extent on the environmental conditions under which the plants are grown. Plants of North Dakota Resistant No. 114 were found not entirely resistant under the high summer temperatures in the greenhouse.

In conducting experiments of this kind, the author suggests that all parent strains to be used in crossing be thoroughly tested on infected soils under unfavorable conditions before making crosses, and that hybridization experiments be conducted under uniform environmental conditions in order to obtain conclusive results.

On the resistance to fungicides shown by the hop mildew (*Sphaerotheca humuli*) in different stages of development, E. S. SALMON (*Ann. Appl. Biol.*, 5 (1917), No. 2-3, pp. 93-96, pl. 1).—The experiments carried out on Erysiphaceae, as previously noted by the author in connection with Eyre (E. S. R., 37, p. 47), were conducted on the assumption that the resistance of the fungus to the fungicidal properties of a chemical would be highest when conidiophores and conidia were most evident. Experiments by the author during 1916 with hop plants, however, are said to have shown that the mildew growing on the host plant is more difficult to kill when at an earlier stage of its development. The details of two experiments are given. Evidence collected is said to indicate that the age of the mildew, even when in the powdery conidial stage, is a factor of importance, the older conidial patches showing less power of resistance than the young patches to the soluble sulphid spray. Apparently the age and condition of the leaf are to some extent concerned, the mildew on old hop leaves having less resistance than on vigorous young leaves. Other factors are thought to be involved. It still remains to be determined at what stage it is most economical to employ the fungicide.

Neck rot disease of onions, M. T. MUNN (*New York State Sta. Bul.* 457 (1917), pp. 363-455, pls. 11, fig. 1).—Under the name neck rot disease the author describes an affection of onions known to occur in all the principal onion sections of the United States, where it causes heavy losses in stored onions and frequently in the growing crop and the seed crop.

The cause of the disease has been referred to a number of species of fungi, but as a result of his studies the author claims that it is due to *Botrytis allii*. The infection of the bulbs in the field is said to occur through the leaves and necks, the fungus passing down the neck and causing a rot in the field or else going into the storage house where the disease develops rapidly under favorable conditions. The bulbs may also become infected from the soil and the seed heads from wind-blown spores which cause a blasting of the flowers.

As a result of his investigations, the author has found that the fungus produces appreciable amounts of oxalic acid, but no pathological effect of this acid could be demonstrated. It was found, however, that pectinase was secreted, and from a study of extracts of this material acting on plant tissue, a possible explanation was secured of the tissue changes taking place when the parasite attacks the host.

Various factors favorable to infection were noted, among them immaturity and imperfect curing of the bulbs; the application of commercial fertilizers late in the season or in incorrect proportions; the application of large quantities of stable manure before planting; poor air drainage in the field; and high humidity, high temperature, and poor ventilation in the storage house.

Methods of control have been worked out which include field sanitation, care of the curing crop, and storing in properly constructed and regulated houses. Fumigation of the stock with formaldehyde gas just before or just after storing has been found ineffective against the fungus. While spraying the growing crop with Bordeaux mixture has given some promising results, this method of treatment has not been tested sufficiently to warrant definite recommendations.

A bibliography is appended.

Onion neck-rot in storage houses, F. H. HALL (*New York State Sta. Bul.* 487, popular ed. (1917), pp. 8, figs. 3).—A popular edition of the above.

Early blight of potato and related plants, R. D. RANDS (*Wisconsin Sta. Research Bul.* 42 (1917), pp. 48, figs. 10).—The history, occurrence, and economic importance of early blight of potatoes and related plants due to *Alternaria* plants are given, together with studies on the host range of the fungus and its morphology, physiology, and life history.

The disease, which is said to be practically world-wide, causes premature death of the foliage and thus indirectly damages the crop. In Wisconsin, the fungus is known to occur on the potato, tomato, and eggplant, the species previously reported on the Jimson weed being a different form to which the author has given the name *A. crassa*.

Early blight is said ordinarily to make little development until the host plant has passed its period of greatest vigor and is being weakened by external conditions or the drain of tuber formation. Climate and soil were found to exert a controlling influence on the disease, and the conclusion is reached that the development of early blight requires relatively high temperatures alternating with moist periods, in combination with a more or less weakened condition of the plant.

Crop rotation and the destruction of dead potato tops, together with spraying with Bordeaux mixture, are recommended for the control of the disease.

Study of a bacterial disease of soy bean and the nature of the root nodules of *Glycine soja* and *Arachis hypogaea*, P. C. VAN DER WOLK (*Cultura*, 28 (1916), no. 336, pp. 268-285; 337, pp. 300-319).—Besides a discussion of parasitic and so-called symbiotic relationships, the author gives an account, with his explanations, of a soy-bean disease which, appearing first as an etiolated condition, may result in the death of the plant. The trouble appeared to be due to the activities of the bacterium (*Rhizobium beyerinckii*) associated with the root nodules, which are here compared with plant galls.

In health, the nodule maintains close relationship with the leguminous plant by means of outgrowths suggestive of the haustoria of some parasitic plants. Detached nodules, no matter how small, kept in nutritive media but not those kept in water, acted somewhat as individual organisms, attaining a considerably larger size than those naturally attached. The normal and the abnormal processes, as well as the forms and structures which occur in the rootlets, are described in some detail, as is also the behavior of these outgrowths in healthy and in diseased plants.

The trouble appears to be connected primarily with the lowering of resistance and decrease of protective products in the single layer of cells lying between the nodule and the rootlet proper and normally acting as an absorbing organ and also a barrier to these bacteria and furnishing an antidote for their

harmful products. The absence or inefficiency of this barrier results in a condition described as a successful parasitism of the plant by its own nodular bacteria or by abnormally developed outgrowths from the altered nodular structure itself, which thus behaves as a foreign body or a parasitic organism.

The results are discussed of the examination of a large number of *Arachis* and *Sofa* plants, both of which are found to be subject to this trouble when growing under unfavorable conditions. It is thought that this disorder may be somewhat common in leguminous plants.

*Orobanche ramosa* and *O. cumana* parasites of tobacco in Roumania, I. GRINȚESCU (Bul. Dir. Gen. Reg. Monopol. Stat. [Roumania], 2 (1914-15), No. 3-4, pp. 10-31, pls. 2, figs. 7; 3 (1915-16), Nos. 1-2, pp. 1-28, figs. 7; 3-4, pp. 20-23; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 5, pp. 761, 762; Bol. Tec. Cultiv. Tabacochi [Scafati], 15 (1916), No. 3-6, p. 91).—It is stated that among the numerous enemies of tobacco in Roumania the *Orobanchaceae* hold first place for both harmfulness and rapidity of spread. The species known in the various localities named are *Phelipaea* (*O.*) *ramosa* and *O. cumana*, the last being now reported for the first time as parasitic on tobacco in that country. Descriptions are given of both species, their varieties, origin, distribution, and the control measures employed.

Other cultivated plants attacked by these species include hemp, potatoes, and pumpkin.

Dying of young fruit trees, R. WATERS (Jour. Agr. [New Zeal.], 12 (1916), No. 2, pp. 112-121, figs. 3).—Following up the introductory article on this subject by Cockayne (E. S. R., 35, p. 456), the author states that in the course of the preliminary investigations conducted by himself concerning the mortality among fruit trees, thousands of young trees were found to be affected with apple canker (*Nectria ditissima*), New Zealand root fungus (*Rosellinia radiciperda*, dieback (somewhat rarely), or the sour sap condition mentioned in the article referred to.

No fructifications have yet been found on apple twigs showing dieback. The sour sap condition, said to be by far the most common disorder of young apple trees in the Dominion, is closely associated with fructifications producing red or golden fibrils and closely resembling those of apple bark fungus (*Valsa ambiens*); with fructifications producing black or white fibrils; or with a fungus the stromata of which burst through the bark and give crescent-shaped summer conidia similar to those of apricot coral spot (*N. cinnabarina*). Much evidence favors the view that sour sap develops almost exclusively on trees previously weakened by unfavorable soil conditions or treatment, forms of which are discussed under the heads of soil preparation, soil water, feeble nursery stock, unsuitable varieties, bad planting, lack of shelter, and pruning, with mention of other possible causes.

Dying of young fruit trees, R. WATERS (Jour. Agr. [New Zeal.], 14 (1917), No. 3, pp. 190-196).—Emphasizing the claim noted above that the main cause of debility resulting in sour sap of fruit trees is the undue accumulation of water in the low situations in which they are planted and the consequent lack of aeration in the soil, the author outlines the apparent relations of the sour sap condition to the various fungi found in connection therewith.

This condition in the wood, cambium, and bark of young apple trees is commonly followed by the appearance of at least six kinds of spore-bearing organisms, of which there have been identified, with more or less probability, *Valsa ambiens*, *V. aurescens*, *Diplodia griffoni*, and *Fusarium lateritium*. The most marked results of inoculation which were obtained came from tests with a fungus which has not yet been identified. It appears that the fungi associated

with sour sap are commonly saprophytes which are favored by conditions unfavorable to healthy growth, no conclusive evidence of parasitism having yet been obtained. The remedy suggested is removal of the predisposing conditions, particularly that of excessive soil water, though other factors also require attention.

An undescribed bark canker of apple and the associated organism, G. H. Goss (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 117-122, pl. 1).—Owing to delay in the publication of this report, the new combination (*Plenodomus fuscomaculatus*) here proposed has already appeared in other communications by the author (*E. S. R.*, 34, p. 647; 35, p. 653). The canker is here described, and the morphology and classification of the organism are discussed.

A blossom wilt and canker of apple trees, H. WORMALD (*Ann. Appl. Biol.*, 3 (1917), No. 4, pp. 159-204, pls. 3).—Having carried forward the work previously reported by Salmon (*E. S. R.*, 32, p. 148) on brown rot canker of apple, said to be increasing in intensity and destructiveness year by year in the southeast of England and attacking many, perhaps all, of the local varieties, the author gives the results of a comparison of the blossom wilt fungus with other *Monilia* of fruit trees, with the results of inoculation tests and of other studies.

Infection takes place through the open flowers, invading the spur and sometimes resulting in a branch canker. These dead portions produce pustules during the winter and spring, conidia from which infect the blossoms and cause the wilt. After shedding the conidia the canker becomes callused, and the lesion eventually heals. Inoculation of apple blossoms with pure cultures resulted in the death of the inflorescences and spurs and in some cases in cankers, conidia-bearing pustules appearing on the parts during the following winter.

The causal organism is said to be easily distinguished from *M. fructigena* and is provisionally referred to *M. cinerea*, but it is said to show on culture rather a different habit from the fungus bearing that name in America.

Removal of all infected spurs before the blooms open checks the disease, as does also spraying so as to prevent the conidial pustules from shedding their conidia during the period of blooming.

The blossom wilt and canker disease of apple trees, H. WORMALD (*Jour. Nat. Agr. (London)*, 24 (1917), No. 5, pp. 504-513, pls. 4).—The information given in the article noted above from another source is here briefly presented, with some advice to fruit growers.

The yearly apple disease of 1914, W. H. VENABLE (*Vermont Sta. Bul.* 205 (1915), pp. 12, 13).—A description is given of a serious trouble of apples in 1914 in Vermont and New York, in which the fruit was misshapen, depressed, and indented, the flesh below being a mass of brownish, corky tissue. No organism has been found in connection with this trouble, and it is believed to have been due to late frost injury, a sharp frost having been reported during a period when the trees were in full bloom.

The effect of fungicide on the spore germination of Longyear's *Alternaria*, R. W. Goss and S. P. DOOLITTLE (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 183-184).—An organism, sometimes referred to as Longyear's *Alternaria* (*E. S. R.*, 17, p. 780), has been shown to infect apples in widely scattered regions of the United States, causing a core rot which appears to be more susceptible to the influence of Bordeaux mixture than of any other preparation tested, though several which are named gave a measure of control, and lead arsenate increased the value of several. The author gives a brief account of varietal susceptibility, symptoms, microscopical characters, cultural characteristics, and fungicidal tests.



**Lime as a preventive and remedy for gummosis and brown rot in stone fruits.** W. M. FAULKNER ([Corvallis, Oreg.]: *Benton County Courier*, 1917, pp. 34, figs. 3).—Tests carried out for several years are claimed to have shown that slaked lime applied to the roots of young trees as indicated will prevent or cure brown rot or gummosis in sour or sweet cherry, also brown rot of prune or peach. The amount to be used varies from 1 to 3 tons per acre, according to the degree of sourness of the soil. The same result may be obtained, it is claimed, by the use of 4 or 5 times as much hardwood ashes.

**The fig canker, caused by *Phoma cinerescens*.** E. S. SALMON and H. WORMALE (*Ann. Appl. Biol.*, 3 (1916), No. 1, pp. 1-12, pls. 2, fig. 1).—Fig trees of all ages on plantations in the district of Sompfing, Sussex, were found in 1914 to be suffering from fungus attacks of two kinds, one of these being a *Botrytis* causing a die-back which is still under investigation. The other disease is a canker on both the young and the older branches, often close to the ground. The disease is of serious economic importance and may threaten the future of fig growing in this district. The constant occurrence of a fungus with pycnidial fructifications on the cankered area was noted in the field. The causal organism, apparently a wound parasite, has been examined and supposedly identified with *P. cinerescens*.

**Temperatures of the cranberry regions of the United States in relation to the growth of certain fungi.** N. E. STEVENS (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 10, pp. 521-529, figs. 3).—Studies have been made of the temperature and rainfall of the principal cranberry regions of the United States in connection with the occurrence of the fruit rots due to *Glomerella cingulata* and *Fusicoccum putrefaciens*.

These fungi were found to vary greatly in their temperature requirements, and this fact is believed to indicate that the problem of their control will be very different on the Pacific coast and in the eastern United States.

**Orange rusts of *Rubus*.** J. C. ARTHUR (*Bot. Gaz.*, 63 (1917), No. 6, pp. 561-515, fig. 1).—The writer, concurring in the opinion held by Kunkel (E. S. R., 37, p. 457) that the two forms of rust on *Rubus* are distinct and that one is *Gymnoconia interstitialis*, has described the other as a new genus and species, *Kunkelia nitens*. He discusses the acial and the telial form in connection with the hosts used by each form, indicating the geographic range of these two fungi.

**The efficacy of Bordeaux mixture.** V. VERMOREL (*Compt. Rend. Acad. Agr. France*, 3 (1917), No. 3, pp. 80, 81).—The author, referring briefly to his work with Dantony on grape downy mildew (E. S. R., 38, pp. 153, 154), states that the claim of superiority for acid Bordeaux mixture should be made instead for the alkaline spray, which alone should be employed. A strength of 1 per cent of the alkaline mixture is claimed to be even more efficacious than one of 2 per cent of the acid spray. It is claimed that the general adoption of the alkaline spray at the lower concentration would result in a large saving annually. Excess of lime is said to be harmless.

**Report on fungus rot [of avocado].** W. T. HORNE (*Rpt. Cal. Avocado Assoc.*, 1915, pp. 13-16).—A brief descriptive account is given of several types of decay and of organisms present, including both fungi (some of which are named) and bacteria. One rot organism in particular is said to be indistinguishable from that causing black rot of apples in the Middle States. It is suggested that this rot may become very important in connection with avocado culture.

**Citrus scab in Porto Rico.** J. A. STEVENSON (*Porto Rico Dept. Agr. Sta. Bul.*, 17 (1917), pp. 16).—A popular account is given of citrus scab, which is particularly injurious to grapefruit in Porto Rico, with suggestions for some means of reducing loss.

**Brown spot of Emperor mandarins.** G. P. DARNELL-SMITH (*Agr. Gaz. N. S. Wales*, 28 (1917), No. 3, pp. 190-196).—The present article describes in greater detail the experiments (*E. S. R.*, 37, p. 352) conducted during the last two years in connection with control of brown spot of the Emperor mandarin due to *Colletotrichum gloeosporioides*.

The first essential is destruction of diseased wood. An excellent spray is Bordeaux mixture, which is not injurious at a strength of 6:4:50, though half this strength is sufficient after the disease has been brought under control. Early spraying is very essential, but very frequent spraying apparently tends to increase the red scale.

**Walnut blight in the eastern United States.** S. M. McMURRAN (*U. S. Dept. Agr. Bul.* 611 (1917), pp. 7, pls. 2).—According to the author, walnut blight, or *arteriosis*, which has proved very destructive on the Pacific coast, is known to occur in Louisiana, the District of Columbia, Maryland, Delaware, Pennsylvania, and New York.

Studies of the organism causing the disease, made in the summer of 1916, gave results similar to those described from California. Based on the single season's observation, the author reports that late infections are the rule. If his conclusion should generally hold true, it constitutes a striking difference between the disease in the Middle Atlantic States and that on the Pacific coast.

As the results of spraying experiments for the control of the disease in California have not been satisfactory, the author recommends testing and developing resistant varieties.

**Narcissus disease.** J. K. RAMSBOTTOM (*Gard. Chron.*, 3. ser., 61 (1917), No. 1586, p. 207; 1587, pp. 217, 218; 1588, pp. 226, 227).—This is a report of a recent study carried out at Wisley on a disease of narcissus which has been attributed to a *Fusarium*, but is now definitely stated to be due to the nematode *Tylenchus devastatrix*. Field observations show that the disease may appear first in the neck of the bulb, the leaves at and below the soil surface decaying and falling over without showing the twisted growth characteristic of a diseased bulb. The nematode is an active parasite, but has not been shown to pass from bulb to bulb in storage. The organism has been found in both mature and immature carpels. It may pass from the diseased parent bulb to the offset by way of the basal plate, or vice versa. *Fusarium* is thought to play but a small part in the production of the disease phenomena observed in this connection. Discussion of preventive and remedial measures includes rotation, trenching, trap plants, heat, formalin, and lime-sulphur.

The place of origin of this disease is not known.

**Narcissus disease.** J. K. RAMSBOTTOM (*Gard. Chron.*, 3. ser., 61 (1917), No. 1586, p. 204).—This is a summary of the work above noted, with mention of other studies on eel-worm or nematode disease of narcissus.

**Oidium quercinum on chestnut.** A. TROTTER (*Alpe [Italy]*, 2. ser., 3 (1916), No. 2, pp. 42-53; *obs. in Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 5, pp. 758, 759).—The author notes the occurrence of the oak *Oidium* (*O. quercinum*) on chestnut, as previously mentioned by Farwell (*E. S. R.*, 24, p. 652). In the case now recorded the attack occurred on sprouts growing from stumps of trees cut out of season. This attack may have been conditioned, it is thought, by weakness of the host plants due to the late cutting (not earlier than August 1), the altitude, and the fact that the fungus was then in or near its most actively reproductive stage.

**An epidemic of *Cronartium comptoniae* at the Roscommon State nurseries.** C. H. KAUFFMAN and E. B. MAINS (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 188,

189).—Pines at Roscommon (*Pinus ponderosa* and *P. contorta*, but not Scotch pine) were found in 1914 to be infected with a blister rust, the *Peridermium complonia* stage attacking almost every seedling pine, some of which died. *Myrica asplenifolia* showed on its rusted leaves the pustules of the uredospore and the teleutospore stage of *C. complonia*. The teleutospores infect the pine seedlings, the mycelium growing slowly under the bark two or three years, the hypertrophy also developing very slowly. Acidospores produced by the Peridermium stage on the pine infected the sweet ferns during the spring or early summer. It is considered possible that the rust is harbored by one or more of the native pines.

[Rubber diseases], R. D. ANSTEAD (*Planters' Chron.*, 11 (1916), No. 50, pp. 628-630).—This is a very brief account of observations on pink disease of rubber by the author and by W. McRea, and on the good effects of Bordeaux mixture employed in this connection, with an account of preliminary steps taken to inaugurate experimentation on five estates totalling 900 acres.

Abnormal leaf fall of Hevea rubber, R. D. ANSTEAD (*Planters' Chron.*, 11 (1917), No. 5, pp. 54-56).—A program has been drawn up and circulated to the several estates undertaking the study of the leaf fall diseases of rubber. The treatment which is to be thus tested includes the removal of all branches which have died back, also the previous year's fruits and fruit stalks; the collection and destruction of all leaves, fruits, twigs, and branches found on the ground; and the removal of all fruits by June 1 to 10. An alternative to this treatment is the removal by June 1 of the flowers and any stray fruits which may have developed from flowers overlooked.

#### ECONOMIC ZOOLOGY—ENTOMOLOGY.

Principles of economic zoology, L. S. and M. C. DAUGHERTY (*Philadelphia and London: W. B. Saunders Co.*, 1917, 2. ed., rev., pp. IX+428, figs. 302).—A second edition of the work previously noted (E. S. R., 30, p. 52).

Game laws for 1917, G. A. LAWYER, W. F. BANCROFT, and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul.* 910 (1917), pp. 70).—The usual annual summary of the provisions of Federal, State, and provincial statutes, the provisions having been arranged mainly by States and Provinces.

Laws relating to fur-bearing animals, 1917, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul.* 911 (1917), pp. 31).—This is the usual summary of laws in the United States and Canada relating to trapping, open seasons, propagation, and bounties.

Control of the jack rabbit pest in Nevada, R. A. WARD (*Agr. Ext. Univ. Nev. Bul.* 13 (1917), pp. 11, fig. 1).—This is a discussion of the necessity of organized community and farm campaigns, crops destroyed by rabbits, and the ways and means of rabbit extermination.

Control of the California ground squirrel, J. DIXON (*California Sta. Circ.* 181 (1917), pp. 14, figs. 3).—This is a popular account which gives a brief description of the California or "digger" squirrel (*Citellus beecheyi* and subspecies) and measures for its control. It is pointed out that the five most effective methods of destroying these squirrels are (1) poisoning with strychnin; (2) fumigation with carbon bisulphid; (3) trapping; (4) shooting; and (5) encouragement of the natural enemies. Carbon bisulphid is most effective when the soil is damp; strychnin-coated barley is best used during the dry season; trapping and shooting are effective at any time, but are from six to twelve times more so before the young are out, before April 1, than later in the season. Powdered strychnin (sulphate) in fresh vegetables and fruit is specially effective in the dry season when green food is scarce.

Handbook of birds of the western United States, including the Great Plains, Great Basin, Pacific slope, and Lower Rio Grande Valley. FLORENCE M. BAILEY (Boston and New York: Houghton Mifflin Co., 1917, 7. ed., rev., pp. 11+374, pls. 33, figs. 601).—A revised pocket edition of the work previously noted (E. S. R., 14, p. 551).

Notes on North American birds, H. C. OBERHOLSER (*Auk*, 34 (1917), Nos. 2, pp. 191-196; 3, pp. 321-329; 4, pp. 465-470).

Notes on the genus *Puffinus*, H. C. OBERHOLSER (*Auk*, 34 (1917), No. 4, pp. 471-475).

The shedding of the stomach lining by birds, particularly as exemplified by the Anatidae, W. L. McATEE (*Auk*, 34 (1917), No. 4, pp. 415-421, pls. 2).

The food of nestling birds, H. E. ENDERS and W. SCOTT (*Proc. Ind. Acad. Sci.*, 1915, pp. 323-337; *abs. in Auk*, 34 (1917), No. 4, pp. 494, 495).—This is a report of field studies of the number of feedings of broods of the brown thrasher, robin, wood pewee, and kingbird and the general nature of their food.

English sparrow (*Passer domesticus*) feeding on the larva of the elm-tree beetle, N. E. WILMOT (*Auk*, 34 (1917), No. 4, pp. 479, 480).—In addition to feeding on the elm-tree beetle in large numbers on the trunks of trees, the author observed the English sparrow to feed upon small moths on the wing, May beetles, etc. He is of the opinion that this sparrow is becoming more omnivorous each year.

[The attraction and protection of birds], E. H. FORBUSH (*Agr. of Mass.*, 1918, pt. 2, pp. 191-263, pls. 7, figs. 10).—A discussion (1) of the food plants that attract birds and protect fruit, including diagrams taken from Farmers' Bulletin 621, previously noted (E. S. R., 32, p. 347), which show the seasons of fruits attractive to birds and of fruits useful to protect cultivated varieties, and (2) of the natural enemies of birds as previously noted (E. S. R., 38, p. 54).

Hydrocyanic acid gas as a soil fumigant, E. R. DE ORO (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 9, pp. 421-436, pl. 1, fig. 1).—This is a detailed report of investigations conducted at the California Experiment Station, the results of which have been summarized as follows:

"The toxicity of hydrocyanic acid gas solutions varied with the insects experimented upon, from the minimum for house flies of 0.0156 gm. of sodium cyanid per liter (equivalent to 0.0046 per cent of hydrocyanic acid gas over the solution) to the maximum for beetles of 0.125 gm. sodium cyanid per liter (equivalent to 0.0365 per cent of hydrocyanic acid gas over the solution), the latter being the most resistant of any insect experimented upon. Gas from a solution of approximately the same strength as that used above on house flies retarded the germination total of lettuce seed 11.3 per cent. Lettuce seed is not killed by two days' exposure to hydrocyanic acid gas as strong as 0.0366 gm. of sodium cyanid per liter (equivalent to 0.0109 per cent of hydrocyanic acid gas over the solution) and will give a good germination percentage if removed at the end of this time.

"Stimulation was greatest at a point one-sixteenth of that causing retardation, namely, 0.0011 gm. of sodium cyanid per liter (approximately 0.00033 per cent of hydrocyanic acid gas over the solution).

"Solutions of hydrocyanic acid gas approximately 256 times as strong as that necessary to produce gas having the minimum killing strength for flies were fatal to all seedlings tested and to 50 per cent of the cuttings placed in the solution, while a solution approximately twice as strong as that required to produce a gas concentration fatal to flies had no effect even upon seedlings.

"Sodium cyanid solutions introduced into the soil failed to give a trace of hydrocyanic acid gas in air drawn from the soil. The use of pressure in

forcing gas into the soil did not materially increase the rate at which it could be introduced. Soil and water are both strong absorbents of hydrocyanic acid gas. Retention of hydrocyanic acid gas by the soil is dependent upon the character of the soil, while that of water remains constant under uniform conditions of pressure and temperature.

"The variability of gas absorption by the soil makes it practically impossible in field work to estimate the dosage of sodium cyanid required to give a toxic effect on insects and at the same time to be within the margin of safety to plants. In small amounts of soil of a uniform character it is possible to determine experimentally the margin of safety between certain insects and plants. A heavy damp or a very wet sandy soil is almost impervious to hydrocyanic acid gas. A pure sandy soil when wet will take up hydrocyanic acid gas only in proportion to the amount of water present and this may again be given off, but gas in contact with a clay soil either enters into a chemical combination with some of the soil constituents or is adsorbed by the soil particles. Gas generated in a soil body diffuses with extreme slowness in clay soils or very wet sandy soils, but in sand with a medium amount of moisture, the diffusion of gas is much more rapid. The use of sodium cyanid offers a satisfactory means of fumigating masses of loose, porous soil, especially those with only small amounts of clay, or of seed beds and potting soil. Such treatments allow of much wider range of concentrations when the soil is not occupied by a crop."

**Ventilation after fumigation.**—Artificial ventilation of ships after fumigation with hydrocyanic acid gas, S. B. GRUBBS (*Pub. Health Rpts. [U. S.] 32 (1917), No. 42, pp. 1757-1761, pls. 2*).—"Quarantine stations at which hydrocyanic acid gas fumigation is practiced should be equipped with mechanical means for artificial ventilation. The gasoline-driven fan as adapted for this use is satisfactory for the prompt ventilation of compartments of vessels after fumigation. For the expeditious handling of large vessels three machines are recommended, two of the horizontal pattern (downward thrust) and one of the vertical pattern (horizontal thrust)."

**Fumigation hints** (*Cal. Citrogr., 2 (1917), No. 12, p. 4*).—This is a summary of recommendations made by R. S. Woglum of the U. S. Department of Agriculture relative to the injury by and dosage of hydrocyanic acid gas in fumigation work with citrus. Attention is called to the fact that trees, the branches of which have been sprayed with Bordeaux mixture or painted with Bordeaux paste, should not be fumigated since it will result in a serious burning. Trees sprayed with lime-sulphur are unaffected by fumigation, as is the case with trees of which the trunk alone has been treated with Bordeaux.

**Effect of smelter gases on insects**, R. W. DOANE (*Science, n. ser., 46 (1917), No. 1186, pp. 295, 296*).—During the course of several summers spent in studying insects in regions where smelters are located, the author has detected no differences in the number of insects or the extent of insect injury due to the presence of smelter gases. Fumigation tests with sulphur dioxide in strengths of from 5 to 25 parts to 1,000,000 parts of air failed to demonstrate an insecticidal effect, and he concludes that the sulphur dioxide given off by the smelters has no effect whatever on the insects in that region.

**The natural immunity or resistance of plants to insect attack**, R. C. TREHERNE (*Agr. Gaz. Canada, 4 (1917), No. 10, pp. 855-859*).—A general discussion of this subject.

**Some problems of sex ratios and parthenogenesis**, O. B. WILLIAMS (*Jour. Genetics, 6 (1917), No. 4, pp. 255-267, figs. 5*).—"Aleyrodes vaporariorum has two races, one of which, found in England, produces females parthenogenetic."

ally; the other, found in the United States, produces males. A colony of what is apparently the male-producing race has been found in England. Fertilized eggs give an equality of the two sexes."

Ninth annual report of the Quebec Society for the Protection of Plants from Insects and Fungus Diseases, 1916-17 (*Ann. Rpt. Quebec Soc. Protec. Plants [etc.]*, 9 (1916-17), pp. 145, figs. 49).—Among the papers presented in this, the usual annual report (E. S. R., 37, p. 156), are the following: Masterpieces of American Economic Entomology, by W. Lochhead (pp. 12-18); A Few Notes on the "Pear Tree Slug," by J. C. Chapais (pp. 25-27); Carriers and Injuncts for Dusting, by C. E. Petch (pp. 28, 29); Cabbage Insects, by A. Gibson (pp. 30-41); What Insecticides and Fungicides Shall We Use in 1917, and When Shall We Spray This Year? by Father Leopold (pp. 42-44); Historical Notes on Entomology in the Province of Quebec, by V. A. Huard (pp. 54-59); The White Pine Weevil, *Pissodes strobi*, in Quebec, by J. M. Swaine (pp. 60-64); Two Instructive Shade Tree Borers (*Cyllene robinia* and *Agrilus auratus*), by C. B. Hutchings (pp. 65-70); The Commoner Grass Moths of Quebec, by J. A. Corcoran (pp. 71-77); Animal Parasites and Rural Sanitation, by W. A. Riley (pp. 80-109); The Eye-Spotted Bud Moth, by E. M. DuPorte (pp. 118-137); and Near Relatives of Insects Injurious to Plants and Animals, by W. Lochhead (pp. 138-144).

Report of the Dominion entomologist for the year ended March 31, 1915, by G. Hewitt (*Canada Dept. Agr., Rpt. Dominion Ent., 1915*, pp. 40, pl. 1, figs. 5). This reports briefly the work of the year under the headings of administration of the Destructive Insect and Pest Act, and insects affecting cereals and other field crops, fruit crops, forest and shade trees, domestic animals and man, and the garden and greenhouse. A map showing the distribution of the brown-tail and gipsy moths in 1914 and the places in Canada where parasites and predaceous beetles have been distributed to date is appended.

Annual report of the entomologist, A. H. RITCHIE (*Ann. Rpt. Dept. Agr. Jamaica, 1917*, pp. 28-34; *abs. in Agr. News [Barbados]*, 16 (1917), Nos. 401, pp. 282, 283; 402, pp. 298, 299).—The occurrence of the more important insects of the year ended March 31, 1917, is reported upon under the headings of sugar cane, coconut, citrus, pimento, pineapple, storage, corn, truck crop, stock pests, etc.

The West Indian sugar cane leaf hopper (*Stenocranus saccharivorus*) was the most important cane pest worked with. Two new host plants, the mahwa tree (*Bassia latifolia*) and the wampee (*Clausenia wampei*), are recorded for the spray white fly (*Aleurocanthus woglumi*), which has spread throughout Jamaica since its discovery in 1913 and is a most serious pest of citrus.

Insect pests in British Guiana in 1916, H. W. B. MOORE (*Abs. in Agr. News [Barbados]*, 16 (1917), No. 400, pp. 266, 267).—A small undetermined pyralid moth borer of the subfamily Phycitinae, discovered in 1916 and apparently new to science, has a wide distribution in British Guiana. The shoot is attacked in a manner quite different from that by the other small borers. As a rule it bores straight to the heart and then merely eats out a small cavity instead of making a longitudinal tunnel. Notes are given on the small moth borers (*Diatraea saccharalis* and *D. canella*), which do considerable damage, the large moth borer (*Castnia licus*), the small black hardback (*Dyscinetus bidentatus*), the froghopper (*Tomaspis flavilatera*), etc.

A summary of the work of the pest control section for the year 1916, D. B. MACKIE (*Philippine Agr. Rev. [English Ed.]*, 10 (1917), No. 2, pp. 128-135, pls. 3).—This summary records the work in the locust campaign, with diseases and pests of coconut palms, the control of the tobacco beetle, sugar

cane pests, pests of abaca, insects affecting rice, and diseases and insect pests of citrus trees, educational propaganda in connection with pest control, and work in apiculture with *Apis mellifica*, *A. indica*, and *A. dorsata*.

[Insects of economic importance in Great Britain] (*Ann. Appl. Biol.*, 4 (1917), No. 1-2, pp. 1-14, 28-46, 75-90, figs. 5).—The papers here presented include the following: Frit Fly (*Oscinus frit*) Attacking Winter Wheat, by F. R. Petherbridge (pp. 1-3); Some Farm Insects Observed in the Aberystwith Area, 1913-1916, by C. L. Walton (pp. 4-14); The Life History and Economy of the Cheese Mites, by Nellie B. Eales (pp. 28-35); Investigation of Bulb Rot of Narcissus.—I. The Nature of the Disease, Due to *Tylenchus devostatrix*, by E. J. Welsford (pp. 36-46); and A List of Coccidæ Affecting Various Genera of Plants (pp. 75-89), and a Note on the Immunity of Chalcid Parasites to Hydrocyanic Acid Gas (p. 90), by E. E. Green.

[Insects of economic importance in Italy] (*Redia*, 12 (1917), No. 1-2, pp. 1-359, pls. 5, figs. 17).—The papers here presented include the following: Aspidiotiphagus and Prospaltella, by A. Berlese (pp. 1-13); A Case of Endophagy of *Aspidiotiphagus citrinus* on *Chrysomphalus dictyospermi*, by E. Malenotti (pp. 15-18); First Century of New Acarids, by A. Berlese (pp. 19-67); A Second Series of Experiments on the Influence of Some Chemicals on *Bumby mori*, by C. Cavazza (pp. 69-108); On the Variation in *C. dictyospermi*, by E. Malenotti (pp. 109-123); Second Century of New Acarids (pp. 125-177) and *Scutellista gigantea* n. sp. (pp. 179, 180), by A. Berlese; *Signiphora merelli* n. sp. (pp. 181, 182), New Diaspinæ (pp. 183-194), and *Prospaltella fuacata* n. sp. (pp. 195, 196), by E. Malenotti; Contribution to the Knowledge of the Aphididae, by G. del Guercio (pp. 197-277); Orthoptera Collected in Southern Italian Somali, by E. Giglio-Tos (pp. 279-287); Third Century of New Acarids, by A. Berlese (pp. 289-338); *Metataptus torquatus*, a New Genus and Species of Chalcididae, by E. Malenotti (pp. 339-341); and Revision of the Genus *Hydrozetes*, by L. Chinaglia (pp. 343-359).

[Insect pests in the Federated Malay States] (*Agr. Bul. Fed. Malay States*, 5 (1917), No. 8-9, pp. 327-357).—The Diseases and Pests of the Coconut Palm are discussed by R. M. Richards (pp. 327-337); The History and Present Position of White Ant Treatment in the Malay Peninsula, by P. B. Richards, acting government entomologist (pp. 338-348); and the Application of the Agricultural Pests Enactment, by F. W. South, chief agricultural inspector (pp. 349-357).

Some important insect pests of cotton in the Punjab, MADAN MOHAN LALI (*Lahore, Punjab: Dept. Agr., 1917*, pp. [8], pls. 3).—Brief descriptions are given of three of the most injurious pests of cotton in the Punjab, namely, a cotton bollworm, the red cotton bug, and the dusky cotton bug, including colored plates of each, showing the various stages and the nature of injury.

Insects attacking fruit trees, L. CAESAR (*Ontario Dept. Agr. Bul.* 259 (1917), pp. 55, figs. 59).—A summarized account is given of the more important insect pests attacking fruit trees and means for their control, under the headings of insects attacking the apple, pear, plum, cherry, and peach.

The insects which attack the wood of fruit trees, P. LESNE (*Rev. Hort. [Paris]*, 89 (1917), No. 19, pp. 300-302, pl. 1).—This brief account is accompanied by a colored plate illustrating several of the important wood-attacking species of Coleoptera and Lepidoptera and the nature of their work.

Cranberry insect problems and suggestions for solving them, H. B. SCAMMELL (*U. S. Dept. Agr., Farmers' Bul.* 860 (1917), pp. 42, figs. 38).—This publication, which supersedes Farmers' Bulletin 178 (*E. S. R.*, 15, p. 381), gives a popular summary of the present status of the knowledge of cranberry insects and means for their control.

Some insects injurious to cacao plants in the Belgian Kongo (*Bul. Ent. Research*, 8 (1917), No. 1, pp. 111-118, figs. 3).—The present paper consists of descriptions of a number of species new to science, collected by the government entomologist in the Belgian Kongo, R. Mayné.

[Report of the entomologist], E. A. ANDREWS (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, No. 2 (1916), pp. 81, 82, 87, 88).—Mention is made of the more serious pests of tea.

A preliminary list of the insects of the Province of Quebec. III, G. CHAGNON (*Ann. Rpt. Quebec Soc. Protec. Plants [etc.]*, 9 (1916-17), Sup., pp. 161-277).—This third part (E. S. R., 34, p. 449) lists 1,810 species of Coleoptera as occurring in the Province of Quebec.

Report on a collection of termites from India, KARIN and N. HOLMGREN, trans. by T. B. FLETCHER (*Mem. Dept. Agr. India, Ent. Ser.*, 5 (1917), No. 3, pp. 153-171, fig. 1).—This systematic account, based upon collections made in diverse parts of India by T. B. Fletcher, includes descriptions of a large number of new species, one new genus, and one new subfamily.

The second experimental campaign for the destruction of locusts in Morocco by means of d'Herelle's method, H. VELU (*Ann. Inst. Pasteur*, 31 (1917), No. 6, pp. 277-290; *abs. in Trop. Vet. Bul.*, 5 (1917), No. 3, pp. 210, 211).—This reports upon the results of work carried on from March to July, 1916 in continuation of that previously noted (E. S. R., 30, p. 857).

A new thrips damaging orchids in the West Indies, C. B. WILLIAMS (*Bul. Ent. Research*, 8 (1917), No. 1, pp. 59-61, fig. 1).—Under the name *Physothrips rosahiae* the author describes a new thrips which has recently caused much damage to orchids grown for ornamental purposes in Trinidad.

Observations on the cotton stainer in St. Vincent, W. N. SANDS (*West Indian Bul.*, 16 (1917), No. 3, pp. 235-252, pls. 2, fig. 1; *abs. in Agr. News [Barbados]*, 16 (1917), No. 403, pp. 308, 309).—A report of studies of the life history and habits and of control measures for *Dysdercus delauneyi* (E. S. R., 36, p. 654).

Trapping of the cotton stainer (*Agr. News [Barbados]*, 16 (1917), No. 400, p. 267).—A brief report of experiments in the trapping and destruction of the cotton stainer (*Dysdercus delauneyi*) in the field in St. Vincent. The cotton stainers are attracted to traps of cotton seed, placed under cacao trees surrounding silk cotton trees that have been destroyed when heavily infested with the cotton stainer, and killed by means of a gasoline torch without destroying the effectiveness or attractiveness of the bait of the traps.

A revision of the genus *Lygus* as it occurs in America north of Mexico, with biological data on the species from New York, H. H. KNIGHT (*New York Cornell Sta. Bul.* 391 (1917), pp. 557-645, pl. 1, figs. 55).—In this revision the author recognizes 67 forms of *Lygus* of which 28 species occur in New York State and 9 occur in neighboring States which will doubtless soon be found within New York borders. Thirty-four species and 11 varieties are described as new. "Food plants and other biological data are given for all but one of the species known to occur in this State. The present paper gives a much-needed systematic revision of the group; but the most important feature is that structural characters found in the male genital claspers have been worked out and shown to furnish a reliable criterion for recognition of the species."

A bibliography of five pages is included.

The Derbidae of the Philippine Islands, F. MUIR (*Philippine Jour. Sci.*, Sect. D, 12 (1917), No. 2, pp. 49-105, pl. 1, figs. 4).—Ninety-eight species representing 39 genera of this family of Hemiptera are described from the Philippines, of which 7 genera and 61 species are new.



**Biology of the Membracidae of the Cayuga Lake Basin, W. D. FUNKHOUSER** (*New York Cornell Sta. Mem. 11 (1917), pp. 181-445, figs. 331*).—This memoir reports investigations made of 61 species of membracids representing 21 genera belonging to three subfamilies, found particularly in the vicinity of Ithaca, N. Y. Keys are given to the genera and species with technical descriptions and brief accounts of their life histories, an account of the external and internal anatomy of the Membracidae, etc. Among the subjects discussed are the geography and physiography of the Cayuga Lake Basin, climatology of the basin, the basin as a floral and faunal area, distribution and range of the family, a comparison of Cayuga Lake Basin with the State as a whole, theories of origin and paths of migration, hosts, migrations, habits, attendance by ants, communal life, ecology, natural enemies, economic importance, methods of collecting and preserving, etc. A check-list of the genera and species and a 12-page bibliography are included.

**The Indian sugar cane leaf hopper (*Pyrilla aberrans*), C. S. MISRA** (*Mem. Dept. Agr. India, Ent. Ser., 5 (1917), No. 2, pp. 73-156, pls. 11, figs. 9*).—This is an extended report of studies of a fulgorid which first came to attention in 1905, during which year it appeared in large numbers in the experimental series of canes at Pusa. Since that time it has been a source of serious injury to cane in 1906, 1907, 1910, and 1914. Three chalcidids, two of which have been determined as *Ooencyrtus pyrrilla* and *Tetrastichus pyrrilla*, two dryinids, *Dryinus pyrrilla* and *Chlorodryinus pallidus*, and a stylopid, *Pyrilloxenos compactus*, are recorded as parasites. An extended account of studies of the biology of *C. pallidus* is given.

**The correct name for our apple-grain aphid, A. C. BAKER** (*Science, n. ser. 46 (1917), No. 1191, pp. 410, 411*).—This is a brief discussion in which the author shows that more than one species of plant lice occurs upon grains and grasses under the name *Aphis avenae* Fab.; that the one of these species which migrates to apple and related trees where the eggs are laid, must be known as *A. prunifoliae* Fitch; that another species, the oat aphid, which migrates to bird cherries in Europe, must be known as *A. padi* L., of which *A. avenae* Fab. is a synonym; that the species now known as *A. cerasifoliae* Fitch migrates to grains and grasses as does *A. padi* and is possibly the same species; and that the present placing of the name "*prunifoliae*" as a synonym of "*cardui* L." is not correct.

**The pink and green aphid of potato, *Macrosiphum solanifolii*, J. S. HOUSER, T. L. GUYTON, and P. R. LOWRY** (*Ohio Sta. Bul. 317 (1917), pp. 61-83, figs. 22*).—This summary of information on *M. solanifolii*, its life history and habits, host plants, nature and extent of injury, natural enemies, and control measures based upon investigations carried on during 1917, is a much more detailed account than that previously noted (*E. S. R.*, 37, p. 849). In the course of the discussion reference is made to the investigation of this aphid at the Maine Station, reports of which by Patch have been previously noted (*E. S. R.*, 19, p. 662; 25, p. 759).

It is stated that while the greatest injury to potatoes during the season was caused by this plant louse, another species, *Myzus persicae*, did some damage to potatoes, having been taken at Batavia, Liberty Center, Celina, and Canton, Ohio. A small potato plant was killed outright at Canton.

The insect hibernates as a shiny black egg, probably more frequently on the rose than on any other host. With the coming of summer the eggs hatch into agamic viviparous females, some of which acquire wings and fly to the potato, where they start the series of generations of agamic viviparous females. About 10 days are required for the daughters to become full-grown and begin

producing young, hence there are many generations during the summer breeding season. The last brood of summer females produces a generation of winged males and wingless females by which the overwintering egg is deposited. At first this egg is greenish but in a few days becomes jet black.

The adults of this species are somewhat more restless than most other aphids and migrate freely from one place to another, thus field-sprayed plants are highly subject to reinfestation. It is pointed out that the matter of reinfestation of plants by migrants should receive careful consideration when control measures are being planned.

In recording its host plants the authors have limited their records to those upon which the female aphid was found producing young. Those heavily infested include the potato, tomato, eggplant, pepper, and sunflower. Those commonly but not heavily infested include the jimson weed, ragweed, lamb's-quarter, sweet potato, canna, hollyhock, and matrimony vine. The hosts not commonly infested include corn, beans, moth mullein, plantain, curly dock, smartweed, shepherd's purse, catalpa shoots, ground cherry, and pokeweed. In addition to these Patch has recorded it on *Iris* sp., *Gladiolus* sp., red root pigweed, turnip, garden pea, apple, pepper vine, cultivated aster, cineraria, and *Lactuca* sp. Thus it appears to be a cosmopolitan feeder, which complicates its control.

Four species of hymenopterous parasites, namely, *Aphidius polygonaphis*, *Pachyneuron aphidivorum*, and two species of *Lygocerus* are said to have been remarkably abundant. Nine species of lady beetles in the adult stage were observed feeding upon the aphids, of which *Hippodamia convergens* was the most common and *Coccinella 9-notata* second in importance. The larvae of three species of *Syrphus* flies were found commonly feeding upon the aphids, namely, *Syrphus americanus*, *Sphaerophoria cylindrica*, and *Allograpta obliqua*. The chipping sparrow, quail, English sparrow, and domestic fowl were observed actively feeding upon plant lice, and a fungus (*Empusa* sp.) was of considerable importance in reducing their numbers.

Control work of the year led to the conclusion that nicotine sulphate, 1.5 to 2 teaspoonfuls to a gallon of water, or about 1:500, with enough soap added to form a suds is the most satisfactory spraying material for the control of this species. Two applications or more may be necessary to control the pest and these applications under conditions such as prevailed during 1917 should not be more than three days apart. Both spraying in the early stages of an outbreak and thoroughness of application are essential to the successful control. Because of the wide range of host plants, clean culture is an important adjunct to control measures. It is stated that with proper equipment, proper material, and thorough work this potato pest may be effectively and economically controlled.

A list of the Aphididae of Japan, with description of new species and genera. S. MATSUMURA (*Jour. Col. Agr. Tohoku Imp. Univ.*, 7 (1917), No. 6, pp. 351-414, pls. 2).—The present list contains 81 species representing 29 genera, among which 57 species and 15 genera are described as new to science.

Contribution to the knowledge of the Aphididae, G. DEL GUERCIO (*Redia*, 12 (1917), No. 1-2, pp. 197-277, pls. 3; *abs. in Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 7, pp. 334, 335).—This paper deals with the classification of 22 species of aphids occurring in Europe, Africa, and America, many of which are of economic importance while others are new or insufficiently described.

*Fraxea elegans* n. g. and n. sp., which occurs on roses in Italy, was the source of more injury than *Macrosiphum rosæ* or *Myzus rosarum* when observed in June. The black peach aphid has been observed in Italy on peaches

of American origin and the injury caused is quite as severe as in the United States. The species infesting Italian Gramineae and citrus plants are noted. The concluding part of the paper reports upon preliminary studies made of several root aphids, namely, *Neorhizobius ulmiphilus* n. sp. on *Ulmus americana* and *U. campestris*; *N. poa* n. sp. on grasses; *N. stramineus* n. sp. on barley; (*Schizoneura*) *Eriosoma ulmi* on currant and gooseberry; and the woolly apple aphid. In the course of three years' experiments the author has failed to demonstrate that the spring alates of the woolly apple aphid migrate from the elm to the apple.

The coccid enemies of the vine in Hungary, J. JABLONOWSKI (*Kisérlet. Közlem.*, 19 (1916), No. 2, pp. 169-288, pls. 8, figs. 22; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 8 (1917), No. 2, pp. 316, 317).—Six species which infest other agricultural plants are said to be of importance as enemies of the vine in Hungary, namely, *Phenacoccus aceris*, *Pseudococcus adonidum*, *P. citri*, *Pulvinaria betulae*, *Eulecanium corni*, and *E. persica*.

Coccidæ of the Philippine Islands, ELIZABETH ROBINSON (*Philippine Jour. Sci., Sect. D.*, 12 (1917), No. 1, pp. 47, pls. 6).—The author records 73 species representing 25 genera from the Philippines, of which 4 species are described as new. A host index is appended.

Orchard injury by the hickory tiger-moth, D. ISELY (*U. S. Dept. Agr. Bul.* 598 (1918), pp. 14, pls. 3).—The present paper is based upon investigations of *Halisidota caryæ* at North East, Pa., during the seasons of 1914, 1915, and 1916. This gregarious summer caterpillar, although a general feeder on deciduous trees and shrubs, causes occasional injury in orchards of pomaceous fruits and cultivated walnuts. The species was first described by Harris in 1841, since which time many complaints have been made of its injury although there appear to be no records of very great destructiveness. It is pointed out by the author that the hickory tiger-moth is the common name which should be applied to this insect since it belongs to the tiger-moth and not to the tussock-moth family. It is distributed over the northeastern United States and the adjacent Canadian Provinces, ranging from the Atlantic Ocean west to Missouri, Minnesota, and Saskatchewan and south to North Carolina and southern Ohio.

Technical descriptions are given of its life stages, including nine larval instars. Forty-nine host plants are listed for the nearly mature larva, but the number of food plants upon which the larva can develop from egg to pupa is much smaller and appears to be restricted to trees of the walnut and hickory family and to pomaceous fruits. The author has reared larvae from egg to pupa on Japanese walnut, English walnut, black walnut, apple, and pear.

There is but one generation annually. Pupation takes place in the fall, the winter being passed in the pupal stage on the ground and the moths emerging in the early summer, apparently as early as the first of June. From 15 to 16 days are required for the egg stage. The duration of the larval feeding period varies greatly and the number of instars varies from 7 to 9. Larvae reared by the author on Japanese walnut in 1915 required from 62 to 85 days from egg to cocoon, with an average of 74.73 days, while in 1916 on the same food plant from 80 to 100 days, with an average of 89.04 days, were required. This variation is thought to have been influenced to some extent by the considerable difference in the amount of rainfall, there having been an excessive rainfall in 1915. The minimum period required for the development from egg to cocoon was 89 days and the longest 96 days, with an average of 92.87 days. The larvae are gregarious in the early stages and even in the later stages molt together. They begin to scatter the latter part of the fourth stage.

The species is remarkably free from parasitic enemies, *Pimpla pedalis* being the only one recorded. While the injury by this pest is intensive and not extensive, it is due to the gregarious larvæ of the early stages which strip branches and sometimes small trees of their foliage and the injury to young trees may be quite severe. It may be controlled readily by spraying with arsenicals; orchards which have been thoroughly sprayed for the codling moth have never been observed to be infested. The caterpillars soon become very hard to poison and large amounts are required to kill them in the later stages.

A list of 19 references to the literature is appended.

**The quince borer and its control**, F. W. PETTEY (*Union So. Africa Dept. Agr. [Pub.] 2 (1917), pp. 17, figs. 10*).—A detailed account of *Coryphodema patis*, a lepidopteran of the family Cossidae, which is distributed all over Cape Province wherever quinces or Wemmershoek apples are grown, but which is not known to occur in any other country. Serious damage is done by boring the branches infested by it or by impairing the bearing capacity of the whole or of parts of the tree.

**Moth borers affecting sugar cane in Mauritius**, D. D'EMMERZ DE CHARMOY (*Dept. Agr. Mauritius, Sci. Ser. Bul. 5 (1917), [English Ed.], pp. 27, pls. 7*).—Summarized accounts are given of the pink borer (*Sesamia vuleria*), the guinea borer (*Proceras sacchariphaga*), the white borer (*Grapholita achianodora*), and the brown borer (*Alucita sacchari*). Descriptions of parasites of these species are appended.

**The sweet potato leaf-folder**, T. H. JONES (*U. S. Dept. Agr. Bul. 609 (1917), p. 12, figs. 4*).—This is a report of studies at Baton Rouge, La., of the pyralid moth *Pilocrocis tripunctata*, the larva of which was first observed to be an enemy of sweet potatoes in Louisiana in 1914. While it has not as yet been observed to occur in destructive abundance in that State, it was very injurious to the sweet potato near Brownsville, Tex., during the fall of 1916, where control experiments with poisons were conducted by M. M. High, a complementary report of which is incorporated in this account.

In addition to Louisiana and Texas the species is recorded from Mexico, Arizona, Cuba, and Grenada, West Indies, and has previously been observed by the author on sweet potatoes in Porto Rico (*E. S. R.*, 33, p. 59).

Technical descriptions are given of its several stages. In addition to the sweet potato the moth has been reared from larvæ found feeding on uncultivated plants of the genus *Ipomoea*, such as bindweed, wild sweet potato, and nodding morning-glory.

At Baton Rouge during the latter part of July and first of August four days are required for the incubation of the egg. In the field the larvæ are found between separate leaves or portions of the same leaf which have been pressed together to form "shelters," each of which usually protects one larva. While the number of larval molts varies, there are usually six, for the development of which 3 days are required for the first instar, 2 days each for the second, third, fourth, and fifth instars, and 5 days for the sixth instar. In the field and in the insectary the pupæ normally are found in loose cocoons within the shelters made by the larvæ, from 6 to 9 days being required for their development. Hibernation appears to take place in the larval stage. The minimum period required for the various stages at Baton Rouge are egg stage 3 days, larval stages 13 days, prepupal stage 2 days, and pupal stage 6 days, a total of 25 days.

The tachinid fly *Exorista pyste* and an ichneumonid (*Bassus* sp.) have been reared from collections of larvæ made in the field at Baton Rouge. Spraying experiments reported indicate that the larvæ can be killed readily by timely

applications of arsenical sprays, either arsenate of lead or zinc arsenite at the rate of 1 or 2 lbs. (powder) to 50 gal. of water.

Results obtained from spraying raspberries with carbolineum for (*Lampronia*) *Incurvaria rubiella*, K. ONSAVER (*Tijdschr. Plantenziekten*, 23 (1917), No. 1, pp. 17-30; abs. in *Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 7, p. 277).—Spraying with carbolineum or banding with adhesive has been found to be the best measure for controlling infestation by this tinelled moth borer, which sometimes infests the raspberry in the Netherlands to the extent of 50 per cent. An 8 per cent strength of carbolineum should be applied to the foliage and roots before March 15.

The toxin of *Sotto bacilli*, K. AOKI and Y. CHIGASAKI (*Bul. Assoc. Sci. Japon.*, Nos. 20 (1916), pp. 1-6; 21 (1917), pp. 1-8).—These data supplement the accounts previously noted (*E. S. R.*, 37, p. 853). The toxin of the *Sotto bacillus* largely remains fixed within the organism; it does not pass through the porcelain filter and disappears after boiling for 10 minutes. The spores are destroyed and the toxin neutralized by Lugol's solution.

Studies in Philippine Diptera, I and II, M. BAZZI (*Philippine Jour. Sci.*, Sect. D, 8 (1913), No. 4, pp. 305-332; 12 (1917), No. 3, pp. 107-161, pl. 1).—A catalogue of Diptera hitherto recorded from the Philippine Islands is first presented, followed by descriptive notes on 200 forms. In the first and second papers, respectively, 2 genera and 17 species and 2 genera and 34 species are described as new.

The Hessian fly, E. N. CORY (*Md. Agr. Expt. Serv. Bul.* 7 (1917), pp. 4, fig. 1).—A summary of information on this pest, including a diagram of its seasonal development and the planting dates between which it is safe to sow wheat in various parts of Maryland.

Sheep maggot flies, III, W. W. and J. L. FROGGATT (*Dept. Agr. N. S. Wales Farmers' Bul.* 113 (1917), pp. 37, figs. 12).—This report of work, carried on during 1915-16 in continuation of that previously noted (*E. S. R.*, 37, p. 160), deals with the reduction of flies by destruction of offal and carrion, trapping flies, blow flies breeding in decaying vegetable matter, baits for attracting and poisoning maggots and adult flies, tests with dips and dressings, chemical notes, dipping and spraying, rendering sheep immune by internal drenches or licks, notes on destruction of birds, and climatic conditions that seem to suit sheep maggot flies in the Riverina. In the first of two appendixes (pp. 27-33) the parasites of the sheep maggot flies, including *Nasonia brevicornis* which has been reared and distributed all over New South Wales, *Chalcid calliphorae* (*E. S. R.*, 36, p. 360), and an undetermined parasite of the shining black fly (*Ophyra nigra*), are dealt with. Appendix 2 (pp. 34-37) discusses an amended classification of the sheep maggot flies dealt with in these reports, with some account of their identification.

Life history, habits, natural enemies, and methods of control of the currant fruit fly (*Epochra canadensis*), H. H. P. SEVERIN (*Maine Sta. Bul.* 264 (1917), pp. 177-247, pls. 4, figs. 7).—This is a summary of the present status of knowledge of the currant fruit fly, based upon a review of the literature and investigations conducted by the author in Maine. Following a brief introduction the subject is dealt with at length under the headings of systematic position, distribution and destructiveness, life history, habits and behavior of adults, natural enemies, and methods of control. A bibliography of 62 titles and an index are included.

The species appears to be confined to North America; in Canada, it is distributed principally in the Canadian zone as far north as Edmonton, Alberta; and in the United States it occurs in the Canadian, Transition, and Upper Aus-

real zones. Wild currants and gooseberries appear to be the native host plants of the species, which is so serious a pest in Maine that frequently the crop of currants and gooseberries is a total loss. The author found the life stages under field and laboratory conditions to vary in 1914 and 1915 as follows: The egg period from 4 to 8 days, larval period from 10 to 25 days, pupal period from 10 to 11 months, mating period from 29 to 38 days, preoviposition period from 6 to 16 days, egg-laying period from 34 to 36 days, and longevity of adults from 29 to 31 days.

In control work the employment of sweetened arsenical sprays appears to have given the most satisfactory results. The author summarizes these results as follows: "In 1914, the results of spraying the foliage with arsenate of lead added to diluted molasses [arsenate of lead 3 oz., molasses 1 gal., and water 2 gal.] showed a loss of 24 per cent of the crop of gooseberries in a commercial garden consisting of 100 currant and gooseberry bushes. In three adjacent berryards 41, 55, and 64 per cent of the gooseberries were infested. The cost of the insecticide for eight applications of the spray to 100 bushes not including labor amounted to 65 cts. In 1915, a baited gooseberry bush growing in the shade showed a loss of 33 per cent of the berries compared with 70 per cent of infested fruit on the check or control bush similarly located, while a treated and untreated gooseberry bush in the sunshine showed an infestation of 17 per cent and 29 per cent, respectively. The poisoned bait, consisting of sodium arsenite and diluted molasses, was applied to the lower branches of the bushes with a bucket pump, while the upper branches were baited with a paint brush. The cost of four baitings applied to 35 currant and gooseberry bushes without labor amounted to 57.5 cts."

The sweet potato root weevil in Florida, K. E. BRAGDON (*Fla. Buggist*, 1 (1917), No. 2, pp. 13-15).—A brief account of *Cylas formicarius*, which has been found in eight counties of Florida, namely, Baker, Brevard, St. Lucie, Palm Beach, Broward, Dade, Monroe, and Lee.

Five years of starvation of larvæ, J. E. WODSEDALEK (*Science*, n. ser., 46 (1917), No. 1189, pp. 366, 367).—This paper relates to the larvæ of *Trogoderma brevicornis*, a small beetle well known as a museum pest. The last of a large number of specimens lived without food for 5 years, 1 month, and 29 days.

The relation of the Malpighian tubules of the hind intestine in the honeybee larva, J. A. NELSON (*Science*, n. ser., 46 (1917), No. 1188, pp. 343-345).

A new species of *Paraphelinus* from British Guiana, with a discussion of the genus and the allied *Aphelinus*, J. WATERSTON (*Bul. Ent. Research*, 8 (1917), No. 1, pp. 43-58, figs. 6).—The genus *Paraphelinus* represented by five species, including *P. perkinsi* n. sp., is considered at some length.

Notes relative to the importation of *Tiphia parallela* from Barbados to Mauritius for the control of *Phytalus smithi*, D. D'EMMEBEZ DE CHARMOY (*Bul. Ent. Research*, 8 (1917), No. 1, pp. 93-102, fig. 1).—An account of introductory work which has resulted in the establishment of *T. parallela* in Mauritius.

The parasites of *Chrysomphalus dictyospermi* in Spain, R. G. MERCET (*Rev. R. Acad. Cien. Madrid*, 14 (1916), No. 11, pp. 776-788, figs. 5; abs. in *Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 7, p. 279).—A species here described as new under the name *Aphycus hesperidum* is parasitic on *C. dictyospermi* on orange trees, laurels, and oleanders in Spain. Two other parasites, *Aphelinus chrysomphali*, and *Prospaltella lounsburyi*, and a lady beetle (*Chilocorus bipustulatus*) are also recorded as enemies of this scale in Spain.

Further experiments on big bud mite, A. H. LEES (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1915, pp. 79, 80; 1916, p. 35*).—In the control of this mite a spray containing 10 per cent soft soap and 5 per cent crude carbolic acid has proved to be the most successful.

The classification and biology of Argentine Ixodidae, R. DIOS (*An. Soc. Rural Argentina, 51 (1917), No. 3, pp. 249-251, figs. 2*).—In this contribution the new species *Amblyomma altiplanum* is described.

The ticks in Paraguay, P. DE LA O. MENDOZA (*An. Soc. Rural Argentina, 51 (1917), No. 3, pp. 251-253*).—A brief discussion of the economic importance of ticks in Paraguay.

### FOODS—HUMAN NUTRITION.

The elements of the science of nutrition, G. Lusk (*Philadelphia and London: W. B. Saunders Co., 1917, 3. ed. rev. and enl., pp. 641, pls. 2, figs. 26*).—This book has the same aim as the earlier edition of which it is a revision (*E. S. R., 22, p. 568*), but many important additions to the facts of metabolism and revisions of its theories have been included. The concluding chapter deals with the question of food economics in relation to the food supply of nations.

The bowfin: An old-fashioned fish with a new-found use (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 26 (1917), pp. 4, fig. 1*).—This circular discusses the bowfin—its habitat, and its use as a food. Methods of cleaning and smoking bowfin are given, also a few recipes for preparing the smoked bowfin for the table.

The burbot: A fresh-water cousin to the cod (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 25 (1917), pp. 4, fig. 1*).—A popular treatise on the uses of the burbot for food. Some recipes are given.

The eulachon: A rich and delicious little fish (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 33 (1917), pp. 4, fig. 1*).—This tells of a good fish not well known to the public and gives ways of preparing it for the table.

The whiting: A good fish not adequately utilized (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 32 (1917), pp. 4, fig. 1*).—The article urges an increased use of the whiting, which is a delicate fish obtainable in large quantities. Recipes for its preparation are given.

Preserving fish for domestic use (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 28 (1917), pp. 2*).—This leaflet urges housewives living near streams and lakes or the seashore to preserve fish for home consumption. Methods for canning and salting fish are given.

The digestibility of the dasheen, C. F. LANGWORTHY and A. D. HOLMES (*U. S. Dept. Agr. Bul. 612 (1917), pp. 12*).—In digestion experiments lasting three days on normal men, using immature and mature dasheens in conjunction with milk, fruit, and butter, with tea or coffee, if desired, it was found that the average coefficients of digestibility for the total diet were protein 80.8, fat 96.1, ash 78.4, and carbohydrates 97.6 per cent. The last figure practically represented the digestibility of the dasheen carbohydrate, and it appeared to be immaterial whether the well-grown dasheen was mature or immature when harvested.

About 1½ lbs. of dasheens were eaten by the subjects daily without any observed physiological disturbances. It is concluded that the dasheen is a valuable addition to the dietary and can well be used to supplement the potato supply and give variety.

The thermal death point in yeast, E. P. WELLS (*Vermont Sta. Bul. 203 (1917), pp. 13, 14*).—Experiments made with the yeast *Saccharomyces cerevisiae* to determine its thermal death point (the lowest temperature that will kill it

in ten minutes) brought out that this point is raised with the addition of sugars or colloids, such as starch.

Living yeast cells were found in loaves baked at 66° C. or less, but none in loaves baked at 68°. "It seems safe to say that the thermal death point of yeast in bread making approximates 68° C."

**Bacteriological examination of canned foods.** A. W. and K. G. BITTING (*Nat. Cannery Assoc. Bul.* 14 (1917), pp. 47, figs. 22).—This article gives as the object of bacteriological examination of canned foods (1) "to determine whether foods which appear normal are sterile; (2) to determine whether foods which appear to be defective are sterile, and if not sterile, whether the spoilage be due to under-processing or to leaks; (3) to determine from the finished product the character of the original material—in legal verbiage whether the product is composed in whole or in part of filthy, putrid, or decomposed material." It gives an explanation of terms used, then takes up in detail the points in both general and microscopical examinations; gives tests for leaks and explains devices for recording pressure and heat penetration within the cans; discusses the results of lack of sterilization; and deals briefly with some of the organisms which cause spoilage.

**The use of microorganisms to determine the preservative value of different brands of spices.** FREDA M. BACHMANN (*Jour. Indust. and Engin. Chem.*, 10 (1918), No. 2, pp. 121-123).—The investigations on spices previously noted (*E. S. R.*, 35, p. 557) were continued by a study of the effect of different brands of spices on the growth of molds, yeasts, and bacteria. Tabulated results of such a study using five brands of cloves, three of cinnamon, and three of allspice are given. Contrary to the earlier results, the investigations indicate that cloves may be as effective a preservative as cinnamon, "that there is considerable variation in the preservative value of the brands used, so that the growth of microorganisms on a spiced medium may be used as a criterion of the preservative value of the brand of the spice."

**Camp cookery.**—A cookery and equipment handbook for Boy Scouts and other campers, AVA B. MILAM, A. GRACE JOHNSON, and RUTH McNARY SMITH (*Portland, Oreg.: The J. K. Gill Co., 1918, pp. 7-108, figs. 5*).—This book contains lists of supplies and equipment for camping, suggestive rations, meal plans, food lists, and some camp recipes. It also gives a suggestive outline for the teaching of camp cooking.

**Basic quantity food tables to be used in determining the daily issue of food to the kitchen** (*New York, N. Y.: Dept. Pub. Charities, 1917, pp. 120*).—The tables given are designed to serve as a quick means of determining the quantity of food necessary for a given number of persons.

## ANIMAL PRODUCTION.

**Influence of the degree of fatness of cattle upon their utilization of feed.** H. F. ARMSBY and J. A. FRIES (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 10, pp. 451-472, pl. 1, fig. 1).—It is the usual experience in cattle feeding that as the animal fattens the increase in weight is made at a greater expenditure of feed. This experiment was made at the Pennsylvania Institute of Animal Nutrition to determine by comparison in a single individual the reasons that might be assigned for this fact. A steer in medium condition was fed a maintenance ration and afterwards a fattening ration made up of concentrates and alfalfa hay. At the conclusion of the trial the steer was fattened to an increase of 300 lbs. and again fed a fattening ration followed by a maintenance ration.



Both when the steer was in medium flesh and when fat the digestibility of the lighter ration was the greater. The results showed the corresponding rations to be equally digested with the unfattened and fattened animal. The relative losses of nitrogen, carbon, and energy in the urine were less on the heavy ration and a little greater in the fattened condition compared with the unfattened. The production of combustible gases was less on the heavier ration with the animal in both medium condition and fattened. The percentage of gross energy of the feed metabolizable was greater in the heavier ration, with the animal in either condition. The larger share of the additional heat in the heavier ration was eliminated by evaporation of water. The heat increment from a unit of feed was but little more in the fattened condition, while the net energy values and percentages of metabolizable energy available for gain were but slightly less.

After an increase in weight of 300 lbs. during three months' fattening the maintenance requirement of the steer was increased 38 per cent, which was greater than the comparative increase in weight or body surface.

"The lower economic efficiency of the fattened animal in this experiment was due chiefly to his higher maintenance requirement and only to a small extent, if at all, to a difference in the utilization of the surplus of feed over the maintenance requirement."

Experiments in crop utilization, C. R. LETTEER (*U. S. Dept. Agr., Bur. Plant Indus., Work San Antonio Expt. Farm, 1916, pp. 19-22*).—Winter oats, field peas, Sudan grass, and Dwarf milo maize were used as pasture for eight pigs averaging 35 lbs. each. As the season was bad because of drought and early frost poor results generally were obtained and no conclusions were drawn.

Two yearling steers were pastured on 1.5 acres of winter oats from December 20, 1915, to March 6, 1916. The oats sown October 21 were divided into quarter-acre plats and were eaten very close at the time of the removal of the steers. The land was then seeded to Sudan grass, but the growth was so poor due to drought that it would support the steers only at intervals and no reliable data could be drawn.

Commercial feeding stuffs, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul. 204 (1917), pp. 6-39*).—The feeding stuffs examined included nearly 600 samples of about 350 brands of cottonseed meals and feeds, linseed meals, gluten feeds, dried distillers' and brewers' grains, wheat offals, hominy feeds, dried beet pulps, alfalfa meal, proprietary feeds, and miscellaneous feeds of provender, corn meal, oats, and rye.

Almost two-thirds of the cottonseed meals, two-fifths of the distillers' dried grains, one-tenth of the wheat feeds, and one out of six of the proprietary and poultry feeds were found deficient in protein. Suggestions are made regarding methods of avoiding buying inferior goods. The feeds examined are listed alphabetically and their guaranties and deficiencies pointed out.

The 28-hour law regulating the interstate transportation of live stock: Its purpose, requirements, and enforcement, H. GOMING and A. J. RACE (*U. S. Dept. Agr. Bul. 539 (1918), pp. 19, pls. 5, figs. 6*).—The text of the present law, passed by Congress in 1906 (*E. S. R., 19, p. 995*), which supplanted the first act of 1873, is given and attention called to its purpose and requirements. Abuses under the law are noted and the favorable results from improved facilities for handling live stock set forth. While there have been many violations of the law and penalties applied, yet the influence has been good and conditions continuously bettered.

Increased cattle production on southwestern ranges, J. T. JARDINE and L. C. HURTT (*U. S. Dept. Agr. Bul. 538 (1917), pp. 31, pls. 12, figs. 2*).—This bulletin

gives certain preliminary results of work done by the Forest Service on the Jornada Range Reserve of about 200,000 acres in southern New Mexico to secure range improvement by natural revegetation, provision of stock-watering places, and determining the carrying capacity of the range as means of preventing overstocking.

The great risk in the live-stock industry of the ranges is that during certain years no rains come. In the past such seasons have wiped out the gains of years. The most uncertain period is from February to the beginning of the summer rains about July. It is advisable therefore to have forage in reserve during this period. In good years the proportion of the number of steers can be increased and in poor years they can be more rapidly sold without loss than the breeding stock. As an additional safeguard in times of scarcity the feeding of a concentrate, as cottonseed cake, should be provided for.

A pit silo of 20 tons capacity was filled with tobosa grass, *Hilaria mutica*, in August and opened late in the winter. The results of attempts to feed it indicate that it is not of economic value either as hay or silage. In another silo 150 tons of silage was made of soap weed, *Yucca elata*. From the preliminary feeding of 10 tons of this silage the indications are encouraging.

As the result of efforts, during three years, in reducing the number of stock during the growing season (July to October) to about half the number the area will carry for the year, and not overstocking during the remaining eight months, and making a better distribution of the watering places, the grama grass range was improved 50 per cent on the Jornada Reserve. For the best grazing of the range as well as the conservation of the forage the cattle should not have to travel more than 2.5 miles to water. This means a watering place for each 13,200 acres, an area that will carry about 500 head of cattle.

During 1916 the Jornada Range Reserve had an estimated carrying capacity of 41.45 acres per head. Where the grama grass makes up the bulk of the forage from 20 to 30 acres are required per head. On flats, slopes, and foothills it takes from 38 to 45 acres to support one head and on the mountain range 60 acres per head.

From 500 selected cows fed about 50 lbs. of cottonseed cake an 81 per cent calf crop was obtained compared to 69.2 per cent with the remaining cows of the reserve and an estimated return of 60 per cent from cows on adjoining unfenced range. Attention is called to the opportunity of increasing the calf crop by keeping poor cows in thrifty condition, by avoiding overstocking the ranges, and by using supplemental feeds when needed.

The average loss of stock on the reserve for 1915 was 1.9 per cent, and for 1916, 1.5 per cent. The average losses for New Mexico are for calves 10.6 per cent, yearlings 5.6, and older cattle 5.8. The small losses on the reserve are attributed to vaccination against blackleg, keeping grass in reserve for poor stock during the spring months, the feeding of a small quantity of cottonseed cake, and the prevention of straying.

The economical winter feeding of beef cows in the corn belt, J. S. COTTON and E. H. THOMPSON (*U. S. Dept. Agr. Bul. 615 (1917), pp. 16, fig. 1*).—An investigation carried out in the corn belt during three years shows that losses in producing beef calves for feeders, when they occur, are usually due to the high cost of maintaining the breeding cows. Attention is called to the importance of feeding farm by-products to this class of animals. Corn stover and straw may be utilized to a greater extent and special attention given to balancing rations.

In an inquiry covering 1,000 farms data on various phases of raising feeder cattle were secured. On 478 farms the average cost of a calf at weaning

time was \$37. This varied in localities and especially in the methods followed by the breeders, ranging from \$25 to over \$50 per head.

The cows on the farms were divided into four lots in accordance with the number of feed units. The cost of winter feed varied with the amount of feed, averaging for the winter for the four lots, \$10.70, \$13.50, \$18.50, and \$21 per head, respectively. It is concluded that large quantities of feed in the last two lots were wasted. From the first lot 800 calves were sold at weaning time at an average profit of \$4.60 per head while 700 from the last group sold at a loss of \$8.00 per head.

In a study of the feeding methods on the 478 farms the cows on those where no cheap roughage was fed were wintered at an average cost of \$18 each. Those using up to 40 per cent of cheap roughage wintered at a cost of \$17.50, those with roughage up to 80 per cent \$13.80, and those with roughage making up over 80 per cent of the ration at \$9 per head.

While the feeding of grain is deemed frequently advisable, as in raising purebred and show cattle, yet it can often be dispensed with. On 154 of the farms studied corn was fed for at least a part of the time to the breeding herd. The average winter feed bill was \$17.10 per head while in the remaining herds where no corn was fed the cost was \$14.80 per head.

The investigations indicated that the feeding of unhusked corn fodder, a practice established years ago, is not profitable now with corn at present prices. Silage, though an excellent feed for breeding animals, was relatively more expensive than much of the cheap roughage.

A study of five representative farms is given with suggestions as to changes that seem in each case advisable.

**Nature and rate of growth in lambs during the first year.** E. G. RITZMAN (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 11, pp. 607-624, figs. 2-5*). Studies, by total weights and the measurements of parts, were made at the New Hampshire Experiment Station of the growth of lambs during their first year and the correlation of different sections of the animal body during this process. The measurements were made largely on skeletal dimensions and were not materially affected by flesh. Body size was measured by height, length of vertebral axis, depth, and spread of frame.

Experiments under way indicate that depth of body is the most satisfactory index of constitutional development. As the proportions of the parts of the bodies of newborn lambs are different from those of more mature animals, the measurements made at different periods and given in tables and diagrams show the proportionate changes taking place.

The most rapid development in the growth of young lambs occurred in the period following birth, decreasing as they reached maturity. In this study the lambs in their first three months made at least 50 per cent of their growth for the first year in dimensions and over 60 per cent of their weight. In their second three months they made 20 per cent, the lessening being partly due to the lambs going on pasture and being weaned. During the third quarter, coming in the fall of the year, the lambs made 20 per cent more growth, and during the fourth or winter period not over 5 per cent. This indicates, from an economic standpoint, that under usual conditions the greatest profits are to be expected when the surplus as lambs is marketed as early in life as they can be fitted for sale.

**Fish meal as a feed for swine.** F. G. ASHBROOK (*U. S. Dept. Agr. Bul. 610 (1917), pp. 9*).—Although fish meal has been used as a feed in foreign countries for some years its use in the United States for this purpose has been almost negligible. While valuable as a fertilizer it is deemed more profitable to first employ it as a feed.

In an experiment made at the Bureau of Animal Industry Experimental Farm at Beltsville, Md., two lots of 12 pigs after weaning were fed 112 days on a basal ration composed of corn meal and middlings, four parts each. In addition one lot was fed one part of tankage and the other one part of fish meal. The lot on tankage made an average daily gain of 1.25 lbs. per head with 3.62 lbs. of feed per pound of gain. The lot on fish meal averaged 1.31 lbs. daily with 3.65 lbs. of feed per pound of gain.

During a second period the same 12 pigs were fed 28 days as follows: Lot 1 on corn meal, middlings, and fish meal, 4:4:1; lot 2 corn meal and fish meal, 9:1; and lot 3 corn meal and tankage, 9:1. Lot 1 made an average daily gain of 1.91 lbs. per head with 4.21 lbs. of feed per pound of gain; lot 2 gained 2.16 lbs. daily with 3.93 lbs. of feed per pound of gain; and lot 3, 2 lbs. daily with 4.02 lbs. of feed per pound of gain.

In another experiment four lots of three pigs each, averaging about 150 lbs., were fed 56 days. Lot 1 on corn meal and tankage, 6:1, made an average daily gain of 1.57 lbs. per head with 4.03 lbs. of feed per pound of gain; lot 2 on dried pressed potato and tankage, 6:1, a daily gain of 0.8 lb. with 6.95 lbs. of feed per pound of gain; lot 3 on dried pressed potato and oil meal, 6:1, a daily gain of 0.91 lbs. with 5.84 lbs. of feed per pound of gain; and lot 4 on dried pressed potato and fish meal, 6:1, 1.32 lbs. with 4.28 lbs. of feed per pound of gain.

The heaviest hog from each lot in these experiments was tested, both meat and lard, to determine whether the fishy odor or taste was apparent. In no case was there any indication that feeding fish meal transmitted any undesirable taint to the pork.

The pigs in the experiments outlined ate the fish meal without trouble and with relish, and were never off-fed during the tests. It proved to be a very effective supplement to a grain ration, and was superior to tankage in that respect in all the comparisons reported.

**Feeding dried pressed potatoes to swine,** F. G. ASHBROOK and R. E. GOSWELL (*U. S. Dept. Agr. Bul. 596 (1917), pp. 10, pls. 2, figs. 2*).—The U. S. Department of Agriculture has been making a study of the preservation of potatoes by drying. An experiment was made at its farm at Beltsville, Md., to determine the value of this product for fattening pigs and the effects of the ration on the quality of the meat.

Four lots of three pigs each, averaging about 150 lbs., were fed for 56 days on the following rations: Lot 1 corn meal and tankage, 6:1; lot 2 dried pressed potato and tankage, 6:1; lot 3 dried pressed potato and linseed oil meal, 6:1; and lot 4 dried pressed potato and fish meal, 6:1. They made an average daily gain with pounds of feed per pound of gain as follows: Lot 1, 1.57 lbs. with 4.03 lbs. of feed; lot 2, 0.8 lb. with 6.95 lbs. of feed; lot 3, 0.91 lb. with 5.84 lbs. of feed; and lot 4, 1.32 lbs. with 4.28 lbs. of feed.

Mixing or soaking the dried pressed potato for from 15 to 20 minutes was the best method of feeding it. The analyses indicate that it should be combined with a high protein feed and the results of this experiment indicate that it is efficient when so fed in producing good gains with pigs.

No difference could be noticed in the curing or the quality of the finished product of the pigs in the four lots.

**Proportions of supplements to corn for fattening swine,** W. L. ROBINSON (*Okla. Sta. Bul. 316 (1917), pp. 57, figs. 23*).—Though it has been well demonstrated that corn must have supplemental feeds combined with it for the best results in fattening swine, the best proportions of the mixture have not been

thoroughly worked out. These experiments were carried on to determine the optimum amounts of tankage, soy bean meal, linseed meal, and skim milk with corn in pork production.

In the first experiment three lots of five pigs each were fed for 16 weeks *jam* after weaning on coarsely ground corn and tankage. In lot 1 the tankage was fed in a definite proportion with the corn, in lot 2 in a constant daily amount, and in lot 3 in a decreasing percentage, beginning with 20 per cent the first week and decreasing 1 per cent weekly to 5 per cent at the close. The results, while not differing greatly, were in favor of the first and third lots.

In a second trial with three lots of four pigs each, averaging 57.5 lbs., lasting 16 weeks, the pigs fed tankage in decreasing amounts each week made larger gains and required less feed per unit of gain than those fed the tankage in a definite proportion with the corn or those on a constant daily allowance.

In a third trial two lots of four pigs each, averaging 75 lbs., were fed for 16 weeks. Lot 1 was fed corn and tankage, 8:1, and lot 2 corn with tankage decreasing from 20 to 5 per cent. The results were the reverse of those in the two preceding trials, the feeding of definite amounts of tankage giving greater increases in weight at a lower expenditure of feed.

In a fourth experiment 30 pigs averaging 47 lbs. were divided into six lots and fed narrow, medium, and wide rations of tankage with corn, the supplement being fed in constant proportions and in decreasing amounts. With large amounts of tankage the best results were obtained in feeding it in a definite proportion to corn. With small amounts of tankage best results were shown when it was fed in larger amounts at first, gradually decreasing the proportions. The medium rations gave better returns than the wide or narrow.

The fifth experiment was made to compare tankage, soy beans, and linseed meal as supplements to corn (the first two in varying amounts) in feeding hogs. Eight lots of five pigs each, averaging 144.9 lbs., were employed. Those fed 16 per cent of tankage in the ration made a 36.2 per cent average increase in rate of gain and required 10.4 per cent less feed than the lot on corn alone. Better returns were given with 10 per cent of tankage in the ration than with 20 per cent or with 5 per cent. As the supplemental feed increased in the ration more of it was required to replace a unit of corn. On a basis of equal amounts of protein soy bean meal and linseed meal gave a higher result than tankage, owing to their nonnitrogenous contents. Tankage was most consistent in producing economical gains. In the beginning of the experiment soy bean meal gave gains with less feed, but in the latter part of the experiment it was surpassed by linseed meal.

In the sixth experiment a lot of six pigs averaging 71.75 lbs. was fed corn and tankage in a self-feeder for 14 weeks, being allowed to select either feed as wanted. They made an average daily gain of 1.5 lbs. per head with the use of 3.89 lbs. of feed per pound of gain. The amount of tankage consumed increased during the first three weeks from 14.6 to 19 per cent of the ration and then decreased to about 5.6 per cent for the last eight weeks of the test. The average consumed during the experiment was 12.4 parts of corn to 1 part of tankage.

In the seventh experiment three trials were made of skim milk as a supplementary feed with corn for pigs in dry lot. Where fed *ad libitum* the pigs consumed less milk as they became older. As the milk was increased in the ration its replacement value with corn was decreased. Compared with tankage as a supplement to corn it was less costly per pound of gain, though there was less difference during the second half of the test than there was during the first half.

In the eighth experiment pigs averaging 79 lbs. were used in five lots of five each in comparing corn and skim milk alone and in combination, and corn and tankage. The experiment lasted 15 weeks. Rations of corn alone and skim milk alone gave poor results compared with a combination of the two feeds. The pigs fed skim milk alone made fair gains but did not fatten. They consumed daily an average of 36.7 lbs. of skim milk each and gained over 1 lb. per day. With a ration of skim milk and corn in equal parts compared with corn alone, 3.37 lbs. of the former replaced 1.37 lbs. of the latter. With skim milk as the supplement to corn, less nutrients were needed per pound of gain than when tankage was the supplement. With tankage, however, the rate of gain was higher.

The ninth experiment was made to secure further data on the use of varying proportions of corn and skim milk for fattening pigs. Seven lots of five pigs each were employed, of which five lots were fed corn and skim milk in different proportions, one corn alone, and one corn and tankage. The initial weight of the pigs averaged 43.6 lbs. and the experiment lasted 15 weeks. The lot fed corn alone made a very poor showing, averaging 0.35 lb. daily gain per head at a cost of 6.85 lbs. of feed per pound of gain. The lot on corn and tankage, 9:1, made a lower rate of gain than any of the lots on a corn and skim milk ration. With corn and skim milk in equal parts, and corn and tankage, 9:1, less dry matter of the skim milk than of the tankage was required per pound of gain. As the proportion of skim milk to corn increased above 50 per cent in the ration there was a decrease in its replacement value. Where the pigs were fed corn and skim milk ad libitum, the ratio of milk to corn increased for the first five weeks and gradually decreased from the seventh to the fifteenth week. The pigs consumed an average of 20.5 lbs. of milk daily or an average of 6.4 lbs. of milk to 1 lb. of corn. Their rate of gain was higher than that of those receiving less milk, while the amount of total nutrients required per pound of gain was lower.

Some conclusions from the results of all the experiments noted are indicated. While further experiments are necessary to determine the best proportion of tankage to feed to pigs, it appears that where as much as 10 per cent is given there is no advantage in feeding a larger proportion in the earlier than in the later period of the test, but where the tankage is 5 per cent of the ration it is advisable to feed a larger proportion in the beginning.

The results indicate that as a supplement to corn skim milk has an advantage over tankage, especially for young pigs. There is believed to be no one best supplementary feed to corn nor one best ratio in which to feed it. There must be taken into consideration the age of the pigs, the market price when finished, and the prevailing prices of corn and available supplements.

**The self-feeder for hogs.** F. G. ASHBROOK and R. E. GONGWER (*U. S. Dept. Agr., Farmers' Bul. 906 (1917), pp. 12, figs. 9*).—In an experiment made at the Department Experiment Farm at Beltsville, Md., two lots of nine pigs each were fed by hand and self-feeder for 70 days on corn meal, middlings, and tankage. The hand-fed lot made an average daily gain of 1.04 lbs. per head at the rate of 4.1 lbs. of feed per pound of gain. The lot self-fed made a corresponding gain of 1.62 lbs. with a food consumption of 4.06 lbs. of feed.

In another experiment lasting 28 days, five pigs on rye pasture, corn meal, and tankage, self-fed, made an average daily gain of 1.61 lbs. per head using 3.63 lbs. of feed per pound of gain. The corresponding gains for five pigs on rye pasture, shelled corn, and tankage, self-fed, were 1.53 lbs. with a consumption of 3.32 lbs. feed, and for a third lot of five on rape pasture, corn meal, middlings, and tankage, 5:4:1, hand-fed, 1.48 lbs. with a consumption of 3.09 lbs. of feed.

From a compilation of results at numerous experiment stations with nearly 600 pigs those hand-fed consumed an average of 5.47 lbs. of feed per head daily and made an average daily gain of 1.23 lbs., while those self-fed ate 8 lbs. of feed daily and made an average daily gain of 1.92 lbs.

Several types of self-feeders are figured and described.

**Killing hogs and curing pork.** F. G. ASHROOK and G. A. ANTHONY (*U. S. Dept. Agr., Farmers' Bul. 913 (1917), pp. 39, figs. 22*).—This publication treats of home equipment for handling pork, and the killing, dressing, cutting, and curing, including lard rendering, brine and dry curing, smoking, and sausage making. A farm smokehouse is described, and a small ice house is figured and specifications for its construction given.

**Standardized war rations for poultry.** H. R. LEWIS (*New Jersey Stat. Laws to Poultrymen, 6 (1917), No. 3, pp. 4*).—The text is given of resolutions adopted at a conference held in New York City November 22, 1917, by representatives of the poultry departments of the colleges of agriculture of New York, Connecticut, Massachusetts, and New Jersey. These resolutions urged the fixing of prices for corn and the compulsory sale of cold-storage poultry products.

The following standardized war rations for poultry were also approved: (1) Scratch rations—cracked corn, feed wheat, heavy oats, and barley, 5:1:2:2; (2) mash—equal parts of wheat bran; wheat middlings; corn meal; corn meal feed, or hominy; gluten feed; crushed or ground bone; and meat scrap.

**Capons and caponizing.** R. R. STOCUM (*U. S. Dept. Agr., Farmers' Bul. 452 (1917), pp. 15, figs. 10*).—A revision of Farmers' Bulletin 452 (E. S. R. 2, p. 375).

## DAIRY FARMING—DAIRYING.

**The relation of the milk-vein system of dairy animals to production.** A. W. ALDRICH and J. W. DANA (*Vermont Sta. Bul. 202 (1917), pp. 3-23, figs. 3*).—Measurements were taken of the milk-vein systems of more than 600 cows in the university herd and in the cow-testing associations of the State. These were compared with the yearly milk and fat yields for as many years as there were records.

Measurements on a few cows were taken several times during the year to find out how much variation there is in the same vein at different stages of the lactation period. A slight increase was found in the size and crookedness of the veins of some young cows after freshening but not enough to affect the outcome appreciably. The age of the cow was not taken into consideration in making up the tables.

Correlation data on the different points compared are tabulated, and the calculations in connection with one of the comparisons are given. It was found that some degree of correlation seems to be traceable as between (1) the size of the milk wells and the milk and fat yields, (2) the diameter of the milk veins and the milk yield, and (3) body length and milk vein length. There also seemed to be some probability that cows showing forks or extensions of the milk vein system may be better milk and butter producers than those not thus favored.

**The influence of the sire on the herd.** J. H. WILSON (*Vermont Sta. Bul. 202 (1917), pp. 39-44*).—During the 20 years in which the station herd consisted essentially of grade Jerseys four pure-bred Jersey bulls were used. Data are tabulated showing the production of the daughters of these bulls and of their dams. Each bull at the time of purchase was thought to be a superior animal, and from the standpoint of pedigree should have done good service. The four methods used for comparing the production of the daughters with that of their

claims are outlined, and the disadvantages of drawing conclusions from such comparisons are pointed out. Bearing in mind the limitations referred to, the author rates two of the bulls as rather unsuccessful, one as a serious detriment, and one as fairly successful.

**Feeding trials with dairy cows in Denmark.** A. V. LUND (*Ber. K. Vet. og Landbohøjskoles Lab. Landøkonom. Forsøg [Copenhagen]*, 89 (1915), pp. 109; *ibid.* in *Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 10, pp. 1478-1481).—The results of the following experiments are noted:

I. *Trials with mangels and turnips.*—In the first test one lot of cows was fed 79.5 lbs. of mangels (9.3 lbs. of dry matter) per head daily, and another lot 84 lbs. of turnips (9.26 lbs. of dry matter). During the test the average increase of milk yield was 0.73 lb. per cow daily, or about 2.5 per cent. for the cows fed mangels as compared with those fed turnips. No difference was noted in the composition of the milk or in the general condition of the two groups of cows.

In a comparison of mangels and turnips of low dry matter content with those of comparatively high dry matter content the results showed that the difference in feeding affected neither the quality of milk, its composition, nor the general condition of the cows.

In testing the effect of roots on the quality of butter 16 cows were fed 99.2 lbs. of turnips each daily, and another lot of 16 cows, 88.2 lbs. of mangels. The butter churned from milk from the turnip-fed lot had a higher iodine number and olein content than that from the mangel-fed lot.

II. *Trials with cacao cake.*—Experiments lasting more than two years were made with two lots of cows, one lot being fed steadily on cacao cake. During the first year 1.75 lbs. per head of peanut and soy bean cake, fed daily to the test lot, was replaced by 2.42 lbs. of cacao cake. The quantity of milk diminished but the fat content did not increase so as to equal that of the permanently cacao-fed lot. In the second year an attempt was made to ascertain the influence of the addition of 1.54 lbs. of cacao cake, particularly as to whether the milk yield was maintained and at the same time the percentage of butter increased. The cacao-fed lot, however, in spite of the addition of cake to its ration, gave less milk than did the other lot, although this contained 0.15 per cent more milk fat, so that the cows of the two lots produced almost the same amount of milk fat. As in the preceding trial, the milk from the cacao-fed lot proved to be richer in protein but poorer in sugar and ash. A similar trial made in the third year gave concordant results.

III. *Poisoning by theobromin due to cacao cake.*—In the experiments here reported by G. H. Hansen, it is noted that cacao cake contains an amount of theobromin approximately equal chemically and pharmacologically to the caffeine content in coffee and tea. Laboratory experiments both with cacao cake and with theobromin on fowls, rabbits, and mice led to the conclusion that, owing to its poisonous character, cacao cake should not be used as a cattle feed.

**Experiments on the use of rice polish in the feeding of milch cows.** R. GUILLANI (*Clin. Vet. [Milan]*, *Rass. Pol. Sanit. e Ig.*, 40 (1917), Nos. 13, pp. 34-39; 14-15, pp. 403-427).—The author describes the milling of rice and its by-products and the physico-chemical properties and keeping qualities of rice polish, including results of analyses. Results are given of experiments with eight cows in feeding rice polish.

It is noted that rice polish is not injurious to the health of cows, but the use of ordinary rice polish which contains some of the finer portions of crushed rice hulls may cause coughing. The amount of rice polish safe to feed



depends, therefore, upon its purity. The feeding of rice polish has practically no influence on the quantity or quality of milk. For maintenance of weight rice polish compares favorably with wheat bran. The cheapness of rice polish makes it of economic importance in the feeding of dairy cows.

The cost of milk and fat production in Vermont in 1911 and 1912, G. M. NELSON (*Vermont Sta. Bul.* 202 (1917), pp. 25-39, figs. 6).—Results are given of a survey in 1911 and 1912 of 71 herds containing 1,547 cows and owned by members of cow-testing associations in seven counties of the State.

The costs other than feed of keeping a cow for a year varied from \$33.39 to \$19.18 and averaged \$36.87. The feed costs varied from \$85.34 to \$21.35 and averaged \$42.18 per cow. Of 58 herds, totaling 1,170 cows, the owners of which were personally visited by the author, the herd average milk production per cow varied from 6,822 to 3,512 lbs. per annum, with a general average of 5,157 lbs. The corresponding milk fat production averages were 343, 142, and 242 lbs. Valuing milk at \$1.80 and skim milk and buttermilk at 30 cts. per hundredweight and milk fat at 32 cts. per pound, with an additional credit per cow of \$1 for a calf and \$8 for manure, the net income per cow varied from \$13.45 for milk and \$5.83 for fat in the low-producing herds to \$33.61 for milk and \$32.39 for fat in the highest-producing herds. The total cost of production varied from \$1.51 to \$1.31 per hundredweight for milk and from 34.5 to 28.5 cts. per pound for fat. In general, the trend was toward more economical production as the herd increased in size.

The data obtained in the study are set forth in graphs and circles.

The cost of producing market milk in 1916-17 on 212 Vermont farms, G. F. E. STONY and W. J. THOMAS (*Vermont Sta. Bul.* 209 (1917), pp. 3-24).—A study is reported of the cost of producing milk during the 12 months ended April 30, 1917, in 212 herds containing 4,650 cows in 12 counties of Vermont, together with comments on the feeding and management of dairy herds under present conditions.

The average total expense per cow on these farms was \$136.11, of which \$66.60 was for feed and \$35.62 was for labor. Deducting \$7.28 for increased value per cow due to abnormal war conditions, \$12.96 for manure, \$3.52 for calf, and 49 cts. for hides and feed bags, there remained a net cost of \$111.96 to be defrayed by the returns from the sale of milk. The average milk production of these herds was 2,478 qts. (5,328 lbs.) per cow. For this amount of milk the cost at the farm was 4.51 cts. per quart, or with a charge of 0.273 ct. per quart for hauling, the cost at the railroad station was 4.78 cts. per quart. The effect of the amount of milk produced per cow upon the cost of production is indicated by data which show that the cost varied from 5.78 cts. per quart on farms averaging 3,535 lbs. per cow to 3.77 cts. per quart on farms averaging 7,701 lbs. per cow.

An outline for computing cost of milk production and blank forms used in securing the data in this study are given.

Concerning the Burlington milk supply, J. E. CARRIGAN and W. T. ANGELL (*Vermont Sta. Bul.* 202 (1917), pp. 44-47).—A study of the conditions under which the milk supply of Burlington is handled and of the possibility of securing a better and more uniform supply at less cost by establishing a central processing plant and decreasing the duplication of delivery routes.

Studies on the hygienic production of milk.—Importance and control of the microflora of the udder in the selection of dairy cows, C. GORINI (*R. Ist. Lombardo Sci. e Let. Rend.*, 2. ser., 49 (1916), No. 14, pp. 480-489; abs. in *Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 10, pp. 1482, 1483).—The author reviews his previous experiments on the micro-

flora of the udder of cows, and gives results of investigations at the Agricultural High School of Milan from which it is concluded that the importance of the microflora of the udder increases as milking approaches the ideal condition of absence of external microbial contamination. The microorganisms of the udder are most often found grouped in albuminous clots, which not only makes their enumeration difficult, but also gives them a marked power to resist heat, although they are not sporulating. The microflora of the udder are not affected by the hygienic condition of the cow sheds, and for this reason bacterial counts of milk may not give a true indication of the cleanliness of the milking process. The microflora of the udder seem to be connected with external and internal factors which still require to be investigated. With certain cows the quantitative and qualitative examination yield such persistently high results that the condition may almost be described as abnormal though not pathological.

For the production of sanitary milk, especially for the feeding of infants and invalids, the author proposes that in the selection of cows not only their state of health but also the microflora of their udders should be taken into account. In the examination of udder microflora the ordinary methods of culture on artificial media can not be used. It is suggested that aseptically drawn milk be examined by the fermentation test, which should be carefully standardized.

What is meant by "quality" in milk, H. A. HARDING, R. S. BREED, W. A. SPACKING, JR., and E. G. HASTINGS (*Illinois Sta. Circ. 205 (1917), pp. 3-16*).—This analysis of the problem by the committee on milk quality of the American Dairy Science Association contains a brief summary of previous work on various phases of the question, a plea for a broader consideration of the problem of milk quality, and suggestions regarding future progress in improving city milk supplies. The elements of quality in city milk are summarized under the headings of food value, healthfulness, cleanliness, and keeping quality. An outline for grading milk is proposed.

Enzymes of milk and butter, R. W. THATCHER and A. C. DAHLBERG (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 9, pp. 437-450*).—At the Minnesota Experiment Station several lots of butter were prepared under carefully controlled conditions of manufacture, and held in cold storage in order to study the effect of varying methods of manufacture and storage upon the keeping qualities of the butter. A study of the enzyme content of the butter after storage is here reported.

Deterioration in quality of butter during storage has been considered by some investigators to be due to the action of enzymes contained in it. Fat-splitting (lipase) or protein-hydrolyzing ("galactase" or casease) enzymes have been suggested as possible agents in causing deterioration. The authors state that lipases are present in butter in very small amounts, if at all, and that they could not be conceived to be sufficiently active at the low temperature used in butter storage to cause any appreciable change in the quality of the butter. The protein-hydrolyzing enzyme was found to be completely inhibited by sodium chlorid in the concentrations which are present in the water contained in all normally salted butters. This fact, together with the known inhibiting effect of low temperatures upon proteolysis by enzymes, makes it impossible that the hydrolysis of proteins in the butter by enzymes plays any part in deterioration changes.

\* Proteolysis in skim milk was completely inhibited by 1 per cent of chloroform and by 15 per cent of sodium chlorid. Galactase can not act in normal butter because of the high salt content. In the separation of milk the factors

which increase the percentage of casein in the total nitrogen also increased the galactase content. The ripening of cream did not increase the rate of proteolysis. No oxidase was found in milk or butter. Only one sample of butter gave any evidence of lipase at the end of four days at 40° C. The enzyme content of butter is very small, because of the high dilution in fat. Expressed on the basis of total nitrogen the butter examined contained as much galactase as fresh whole milk, twice as much catalase, but only one one-hundred-sixtieth as much peroxidase. The cold storage of butter weakens the peroxidases, but has little effect on the catalase and galactase."

It is concluded that enzymes are not to be considered as a factor in the deterioration of butter during cold storage.

A list of the literature cited is included.

**Suggestions for a standard for butter.** H. VEEDER, R. C. McMANUS, W. P. JONES, and G. P. McCABE (*Chicago: Swift & Co., 1917, pp. 75*).—As a result of a study of the provisions of existing laws, decisions of the courts, and other data the following standard for butter is suggested:

"That the only ingredients which may be used in the manufacture of standard butter are those named in the law of August 2, 1880. These ingredients are milk or cream or both, with or without common salt, and with or without additional coloring matter. That milk or cream used in the manufacture of standard butter shall be (1) pasteurized, or (2) from properly tuberculin-tested, nonreacting herds. That milk and cream used in the manufacture of standard butter shall not be filthy, putrid, or decomposed within the meaning of the Food and Drugs Act, and that standard butter shall not be made to contain abnormal quantities of salt or curd, and shall contain a definite minimum percentage of butter fat. For the information of butter makers, there should be a suggestion as to what are the variable limits in standard butter of the normal quantities of such substances. That no standard butter shall be made from butter or butter fat in which any substance whatever has been used to deodorize or remove rancidity. That in the manufacture of standard butter no process or material shall be used which has the effect of causing the butter to absorb abnormal quantities of water, milk, or cream. For the information of butter makers there should be a suggestion as to what are the variable limits in standard butter of normal quantities of moisture. That if it shall be found that small quantities of lime, or of sodium carbonate, or other alkaline salts may be used as ingredients in butter making without violation of the Food and Drugs Act, such butter shall not be standard butter, but shall be defined as 'neutralized butter' or 'limed butter' and shall only come within the terms of such definition when the butter or butter fat from which the product is made has not been deodorized, or had rancidity removed or masked; otherwise it is adulterated butter."

**Making butter on the farm.** W. WHITE (*U. S. Dept. Agr., Farmers' Bul. 52 (1917), pp. 23, figs. 18*).—Detailed directions for making butter under farm conditions are given, together with notes on the causes of difficult churning and the equipment needed for butter making on the farm. A plan for a dairy house is included.

## VETERINARY MEDICINE.

**Pathogenic microorganisms.** W. H. PARK and ANNA W. WILLIAMS (*New York: Lea & Febiger, 1917, 6. ed., enl. and rev., pp. X+17-709, pls. 9, figs. 269*).—In the enlargement and revision of this work (*E. S. R., 21, p. 579*) the authors were assisted by C. Krumwiede, jr., and others.

**Common parasites of farm animals.** W. M. BURSON (*Bul. Ga. State Col. Agr.*, No. 137 (1917), pp. 39, figs. 19).—A popular account of the more important ectoparasites and endoparasites of farm stock.

**Observations on the stability of the erythrocytes of the ox, pig, and sheep.** M. W. LYON, JR. (*Jour. Infect. Diseases*, 22 (1918), No. 1, pp. 49-52).—The ease with which the erythrocytes of the ox, pig, and sheep are broken up by the same agent bears no relation to the zoological position of the three animals. The erythrocytes of the ox on the whole are comparatively stable in certain circumstances and appear to be well adapted as an indicator in complement fixation tests with human serum, much better than are sheep corpuscles. Sheep erythrocytes are comparatively unstable, though relatively resistant to human serum. Their use in complement-fixation tests with human serum introduces a variable factor which is undesirable, although it has probably little effect on the final value of the tests. Erythrocytes obtained at random from different animals on the whole behave similarly from week to week, and appear to be quite as suited for hemolysis experiments and indicators in complement-fixation tests as are the corpuscles from a single animal. Ox erythrocytes seem to have better keeping qualities than the erythrocytes of the pig or sheep."

**The clinical pathology of the blood of domesticated animals.** S. H. BURNETT (New York: The Macmillan Co., 1917, 2. ed., rev. and enl., pp. XVI+166, pls. 49, figs. 24).—A second revised and enlarged edition of this work (E. S. R., 21, p. 78), which is intended as a textbook of hematology (1) for students and practitioners of veterinary medicine, and (2) for investigators, to whom it renders easily accessible data concerning the blood of the kinds of experimental animals commonly used. In this edition what is considered to be the normal for each species is stated. Tables summarizing the results obtained by the different investigations are also given. Each of the 11 chapters is accompanied by a copious bibliography.

**Histology of *Astragalus mollissimus*.** NEVA RITTER (*Kans. Univ. Sci. Bul.*, 1917, No. 8, pp. 197-208, pls. 4).—A report of studies of a loco weed.

The effect of exposure to temperatures at or above 100° C. upon the substance (vitamin), whose deficiency in a diet causes polyneuritis in birds and beriberi in man, HARRIETTE CHICK and E. MARGARET HUME (*Proc. Roy. Soc. [London]*, Ser. B, 90 (1917), No. B 624, pp. 60-68).—"Exposure of wheat embryo to a temperature of about 100° C. for two hours resulted in no significant loss in antineuritic 'vitamin.' If, therefore, it is included in the flour from which bread or biscuit is made, it can be relied upon to retain its antineuritic properties after baking. At temperatures in the neighborhood of 120°, however, there was a swift destruction of antineuritic properties. This fact has an important bearing where diets are largely composed of preserved and tinned foods previously sterilized at temperatures above 100°." In experiments with yeast extract the destruction of the vitamin was rapid at 120°.

**The effect of X-rays upon diseases of bacterial origin.** C. KEMPSTER (*Sci. Jour. Sup.*, 84 (1917), No. 2181, pp. 243, 244).—It is concluded that the effect of X-rays upon diseases of bacterial origin is due to the decided inhibitory influence upon the reproduction and increase in the germs, and to the stimulation of the living tissues resulting in an increased phagocytosis, and not to any germicidal power.

**A new mercurial germicide** (*Jour. Lab. and Clin. Med.*, 2 (1917), No. 9, pp. 66, 67).—Results obtained by Schamberg, Raiziss, and Kolmer, of Philadelphia, in the preparation of a new mercurial germicide are summarized from the report to the National Research Council. It is prepared by the introduction of mercury into the phenol group, and the trade name proposed is Mercurophen. The results of a thorough examination indicate that the new compound is a

much stronger antiseptic and disinfectant than mercuric chlorid, while the precipitating effect on human serum is much less.

Annual report of the civil veterinary department, Bihar and Orissa, for the year 1916-17, D. QUINLAN (*Ann. Rpt. Civ. Vet. Dept. Bihar and Orissa, 1916-17*, pp. 4+8+XVI+2).—The usual annual report (E. S. R., 36, p. 879).

Annual report on the Punjab Veterinary College, civil veterinary department, Punjab, and Government Cattle Farm, Hissar, for the year 1916-17, C. A. H. TOWNSEND, H. T. PRASE, and J. FARMER (*Ann. Rpt. Punjab Vet. Col. and Civ. Vet. Dept., 1916-17*, pp. 11+2+15+XVIII).—The usual annual report (E. S. R., 37, p. 78).

Infection and immunity, V. C. VAUGHAN (*Chicago: Amer. Med. Assoc., 1915*, pp. 238).—This monograph is a part of the Commemoration Volume, issued by the American Medical Association as a tribute to the medical sciences "which made possible the building of the Panama canal." The purpose of the author is to "state the essential facts of infection and immunity accurately and simply, so that they may be understood by the intelligent, nonprofessional man."

The section on infection includes a historical review of the development of the germ theory, chapters on the general characteristics of bacteria and avenues of infection, and separate chapters on 19 diseases of infectious origin, describing briefly the history, organism, and the sources and avenues of infection. The section on immunity includes chapters on phagocytosis, precipitins, agglutination, opsonins, and germicidal sera. The volume closes with a discussion of the general principles and mechanism of infection and immunity.

The intracutaneous absorption of antigen, G. H. SMITH and M. W. COOK (*Jour. Immunol.*, 2 (1917), No. 3, pp. 269-281, fig. 1).—By anaphylactic and precipitin reactions with sensitized, normal, and immunized guinea pigs subjected to intracutaneous injections of antigen, the authors conclude that the absorption of antigen from the cutaneous tissues of specifically immunized animals is much more rapid than in normal animals. The absorption in sensitized is less than in immunized but greater than in normal animals.

The specificity of intracutaneous absorption, G. H. SMITH and M. W. COOK (*Jour. Immunol.*, 3 (1918), No. 1, pp. 35-42).—In this article the subject of intracutaneous absorption of antigen, noted above, is discussed from the standpoint of specificity. Guinea pigs immunized to one antigen were tested by the intracutaneous injection of the specific and of a heterologous antigen to determine the relative rate of absorption of antigen. Precipitin and agglutination reactions were employed. The possibility that normal animals possess a selective action for a certain antigen was disproved by a series of tests with various antigens, no difference in elimination of antigen being noted.

From the results of their experiments the authors conclude that "from the point of view of absorption of antigen, the immune state with the changes dependent upon it is the result of a heightened reactivity for the specific antigen only, and does not stimulate the mechanism of elimination of heterologous antigens." The nonspecific antigen is, moreover, not removed so rapidly from an immunized animal as is the same antigen from a normal animal.

Preparation of protein extracts for diagnostic cutaneous tests, N. S. FERRY (*Jour. Lab. and Clin. Med.*, 2 (1917), No. 3, pp. 655-657).—The following method has been successfully used by the author:

The protein is first extracted with sterile water containing just enough of an oil of high efficiency to act as a preservative. Glycerin is added and the solution evaporated to a standard strength. Sufficient boric acid is added to the extract to make a heavy paste. This is put up in small collapsible tubes and applied with a sterile toothpick. By this method the proteins are thor-

thoroughly extracted, accurately standardized, and well preserved. The paste is nonirritant and perfectly soluble in the body fluids.

[A rapid method for the production of precipitin antigen from bacteria], C. KRAMWIEDE, JR., and W. C. NOBLE (*Jour. Immunol.*, 3 (1918), No. 1, pp. 1-19).—A very rapid method of preparing a concentrated precipitin antigen from bacteria is described. A heavy suspension of bacteria in water is dissolved by boiling in sufficient alkaline hypochlorite solution to give a final concentration of 5 per cent. This is neutralized with normal hydrochloric acid and precipitated with 95 per cent alcohol. The precipitate is boiled with normal saline solution and centrifuged, the supernatant liquid being the finished antigen.

This method differs from others in use in that the hypochlorite solutions are boiled instead of being used in the cold, thereby hastening the process. It is the opinion of the authors that the method is applicable to all bacteria with the exception of the acid-fast types, and should be of value in experimental work where a readily obtainable supply of concentrated antigen is needed.

Contributions to the biochemistry of pathogenic anaerobes.—I, The biochemistry of *Bacillus welchii* and *B. sporogenes*, C. G. L. WOLF and J. E. G. HARRIS (*Jour. Path. and Bact.*, 21 (1917), No. 3, pp. 386-452, figs. 19).—This forms part of an investigation of the pathogenic anaerobes in their relation to wound infection.

Both the organisms investigated have certain properties in common, which they exercise to different degrees. They grow with varying vigor on media with or without the presence of carbohydrates and under favorable conditions produce large quantities of gas. For their growth they are dependent on a certain initial concentration of amino acids. Before gas is evolved their activities seem to be chiefly directed toward a proteolysis in preparation for further development and gas formation.

*B. sporogenes* is particularly potent in its proteolytic action, and during active growth will further digest a peptone solution which has been made by the exhaustive treatment of a protein with trypsin and erepsin. It will break down an albumin-like alkaline egg, until 28 per cent of the total nitrogen originally present is in a form reacting with nitrous acid. Both organisms have butyric acid as an end product. The source of this acid in *B. perfringens* fermentations is unquestionably the sugar group, if sugar be present. *B. sporogenes* forms large quantities of butyric acid in sugar-free media. In those media containing lactose, this sugar is not apparently greatly affected."

Successful treatment of anthrax by various methods, D. G. DUDLEY (*Jour. Amer. Med. Assoc.*, 70 (1918), No. 1, pp. 15-17).—The author has used with success the following method of treatment of anthrax in human beings infected in the handling of hides improperly disinfected. The first treatment, where possible, is excision of the lesion. Eight per cent phenol is injected into the tissues around the lesion, and  $\frac{1}{4}$  in. beyond the phenolized zone five or six syringefuls of 25 per cent alcohol are injected. After the excision, the base and edges of the wound are painted with 95 per cent phenol neutralized with absolute alcohol and wet dressings applied. If the excision fails, continued injection of 8 per cent phenol into the tissues is followed. Antianthrax serum should then be used. The first dose is 35 cc. injected intravenously, followed in from 8 to 16 hours by a second dose given intramuscularly or intravenously. With this treatment strychnin,  $\frac{1}{10}$  grain, is given every 4 hours.

Other methods suggested are the use of normal bovine serum and a steam treatment, useful when the disease is localized.

The diagnosis of dourine by means of the conglutination method, H. WIEBOLD (*Arch. Wiss. u. Prakt. Tierheilk.*, 43 (1917), No. 2-3, pp. 233-238;

*abs. in Trop. Vet. Bul., 5 (1917), No. 3, p. 155).*—"Nineteen dourine sera gave positive results corresponding with those given by the ordinary deviation of the complement test, and to a large extent with the agglutination test, with one exception, in which an animal that had been infected for a considerable time and had then been treated with atoxyl ceased to give a positive result with the complement test, but continued to react strongly according to the agglutination test. Thirty normal sera gave negative results, except at first in two cases where errors of technique were detected."

The author's conclusion is that the agglutination test is applicable for the diagnosis of dourine sera, but that it is more sensitive to errors and therefore more difficult to carry out than the ordinary deviation of complement method.

**Studies on rinderpest, H. SCHEIN** (*Ann. Inst. Pasteur., 31 (1917), No. 11, pp. 571-592*).—This article reports a series of studies on the vaccination of cattle and buffaloes against rinderpest. The work was undertaken because of the unfavorable results with buffaloes of the usual vaccination by simultaneous injections of serum and virus. In the investigations recorded, horses were used as the experimental animals.

The earlier conclusions of Kolle and others that the virus is located in the blood corpuscles were confirmed. The virus was found, for the most part, in the leucocytes but to a slight extent in the plasma. Dilution experiments proved that 0.001 cc. of virulent blood constituted a fatal dose and 0.0001 cc. the limiting infecting dose. Virus was present in 0.1 cc. of centrifuged citrated plasma.

Experiments with specific and nonspecific serums showed that (1) the non-specific serum of the horse has no action on the rinderpest virus, (2) the serum of certain normal cattle can attenuate or kill the rinderpest virus of the horse, (3) the antirinderpest serum probably acts upon the organism of the animal infected and not upon the microbe itself, and (4) the success of vaccination depends on the proportion of serum to virus.

The following method of vaccination of cattle and buffaloes during an epidemic of rinderpest was successfully used: The cattle received, according to size and age, from 40 to 80 cc. of serum; the buffaloes from 100 to 160 cc. Both cattle and buffaloes received 1 cc. of a dilution of virulent blood of 1 to 1,000. The diseased animal (the source of the blood) was punctured in the jugular vein with a small 2 cc. syringe and 1 cc. of blood withdrawn and placed in 1 liter of water containing 8 gm. of sodium chlorid and 2 gm. of sodium oxalate. The solution was boiled and cooled and was used within half a day. It was probable that all the animals inoculated had been infected, but very few deaths occurred in the six villages where vaccination was employed, and the epidemic was completely arrested.

The author concludes from his experience that serum infection appears to give the best results in buffaloes by injecting a sufficient quantity of serum (about 50 cc. per 100 kg. for adults and double the amount for young animals), and infecting it with the least possible amount of virus to retard the growth of the parasite.

**Rocky Mountain spotted fever in California, J. G. CUMMING** (*Jour. Infect. Diseases, 21 (1917), No. 5, pp. 509-514, figs. 5*).—The results obtained from the inoculation of animals has definitely established the occurrence of Rocky Mountain spotted fever in California, while the finding of the tick *Dermacentor varians* in Ventura County and the occurrence of a case there marks that region as a new area of possible prevalence of the disease in the State.

**Experimental trypanosomiasis: *T. equiperdum* infection in the dog, E. R. KRUMBHAR** (*Jour. Infect. Diseases, 22 (1918), No. 1, pp. 34-42, figs. 5*).—"Two

may be readily infected with *T. equiperdum* and a severe anemia be produced, the incubation period varies from 3 to 8 days, and fatal termination results from 3 to 7 weeks. By successive transmission through dogs the virulence of the infection may be increased so that both incubation period and duration of the disease may be shortened and the maximum anemia more quickly reached.

With the appearance of trypanosomes in the circulating blood, the animals show general weakness, loss of weight, lethargy, and a lessened tendency to the healing of wounds. Subcutaneous edema is a common manifestation and may appear as a general anasarca or be limited to the genitalia or the extremities. The edema fluid contains living trypanosomes. Another interesting and almost constant lesion is keratitis. Choloria is constantly present without evidence of pus in the skin or mucous membrane. The anemia which develops is progressive and of the hemolytic type. The hemoglobin may fall to 40, and the red cells to less than 3,000,000 per cubic centimeter."

**Complement fixation in experimental trypanosomiasis.** A. C. Woods and H. H. Morris (*Jour. Infect. Diseases*, 22 (1918), No. 1, pp. 43-58).—"Dogs infected with *Trypanosoma equiperdum* develop complement fixation with a specific antigen within eight days after inoculation. An easily prepared and very satisfactory antigen is the salt solution extract of the spleen of a rat heavily infected with trypanosomes or dead from the infection. The complement fixation usually follows the appearance of trypanosomes in the blood, although it may occasionally precede the appearance of trypanosomes. The complement fixation, however, always antedates the appearance of symptoms. Dogs infected with trypanosomes frequently give a positive Wassermann reaction.

Within three weeks after the appearance of trypanosomes in the blood, the serum of the infected dog becomes strongly anticomplementary. This anticomplementary phenomenon appears to be due to the liberation of anticomplementary substances into the blood by the invading trypanosomes. The blood is rendered sterile, and all clinical symptoms clear up following the intravenous injection of arsenobenzol. In the only complete experiment at hand the anticomplementary action and complement fixation properties with the trypanosome and Wassermann antigens likewise disappeared."

**Concerning the trypanosome of swine in the valley of the Inkissi, J. Congo** (*Bul. Agr. Congo Belge*, 8 (1917), No. 1-2, pp. 148-160).—"In the valley of the Inkissi 36 of 94 domesticated swine examined were found to carry *Trypanosoma congolense*, a human trypanosome, but for them it does not appear to be pathogenic.

**Studies of the tissue reactions to various products of the tubercle bacillus,** E. F. Morse and Ethel Stott (*Jour. Lab. and Clin. Med.*, 2 (1916), No. 3, pp. 167, pl. 1, figs. 7).—"This article reviews the literature on the mechanism of the formation of the tubercle, the predominant theory of previous investigators being that the histological lesion caused by the tubercle bacillus is due to a lesion liberated from the body of the bacillus by action of the tissue cells. The present investigations, which are described in detail, suggest that the lesion is due rather to the waxy substances of the bacillus acting as a peculiar type of foreign body.

**A study of the relative efficiency of the various differential staining methods used in identifying the tubercle bacillus,** N. P. Sherwood (*Kans. Jour. Sci. Bul.*, 10 (1917), No. 3, pp. 25-35).—"The author's investigations have led to conclusions of which the following form a part:

"There is great variation in the acid-proofness of different strains of *Bacillus megateris*. Even in positive sputums there is some fluctorial difference of the tubercle bacillus toward Fonte's stain, whereas with the other methods very



little if any tinctorial variations were observed. The methods of Gabbot, Ziehl-Neelsen, Pappenheim, and of Bunge and Trantenaph are not at all reliable as a means of differentiating the tubercle bacillus from the rest of the acid-fast group. Fonte's method seems to be much superior to the other methods, but not entirely reliable in urine, and even in sputum examinations. The percentage of error can only be determined by much more extensive work. The error of all of these methods seems to be that of giving too many positive results."

A note on Petroff's cultural method for the isolation of tubercle bacilli from sputum and its application to the examination of milk, F. CONSTANCE STEWART (*Jour. Expt. Med.*, 26 (1917), No. 3, pp. 755-761).—The author has applied the Petroff method<sup>1</sup> for the isolation of tubercle bacilli from sputum to the examination of milk. The milk to be tested was digested with an equal volume of 3 per cent sodium hydroxid solution for from 20 to 30 minutes at 37° C. After neutralizing and centrifuging, inoculations from both fat and sediment layers were made on the gentian-violet-egg-meat-juice medium of Petroff.

The organism was recovered from 69.2 per cent of the samples of milk artificially infected. Of 59 samples obtained from widely different sources 5 gave positive cultures, while 29 samples from the Connecticut Bacteriological Laboratory gave negative tests. All of the organisms isolated were of the bovine type. The author believes that with slight modifications, such as the addition of certain amino acids, small amounts of sugar, and phosphates to the Petroff medium, the method should prove constant and reliable for the isolation of tubercle bacilli from milk.

Tuberculosis in equines, E. M. PICKENS (*Cornell Vet.*, 8 (1918), No. 1, pp. 9-25, pls. 3).—The author has compiled from case reports and textbooks data on equine tuberculosis, including history, occurrence, source and channels of infection, symptoms, post-mortem findings, course, and diagnosis. Three typical cases are described in detail.

Infectious abortion in cows, F. M. HAYES (*California Sta. Circ.* 183 (1917), pp. 4).—A popular summary of information.

Bovine hematuria, S. HADWEN (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 6, pp. 822-830).—This paper deals with the symptoms and pathology of the disease and refers to experimental work.

"Injections of dilute oxalic acid solutions<sup>1</sup> provoke great irritation and subsequently the urine is stained with blood. Calcium oxalate crystals are formed in the bladder as soon as the acid comes in contact with the urine and mucus. After a time the urine becomes contaminated with bacteria which no doubt play a part in aggravating and maintaining the lesions. It is probable that the acid has a direct effect on the walls of the bladder as well as the crystals. Two out of the three cases developed a disease indistinguishable from natural cases of hematuria."

The experiments are considered by the author to support the oxalic acid theory of the causation of the disease, which he advanced in the report of the veterinary director general of Canada for 1914 (*E. S. R.*, 36, p. 179).

Redwater or bloody urine in cattle, J. W. KALKUS (*Washington Sta., West. Wash. Sta., Mo. Bul.*, 5 (1917), No. 9, pp. 127-129, fig. 1).—This is a brief popular account of this disease and its treatment, a more detailed account of which by the author has been previously noted (*E. S. R.*, 30, p. 383). As regards the cause of this disease, the author considers the oxalic acid theory of Hadwen, above noted, to be the most plausible.

<sup>1</sup> *Jour. Expt. Med.*, 21 (1915), No. 1, pp. 38-42.

Studies of an obscure cattle disease in western Nevada, W. B. MACK and E. HARROLD (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 2, pp. 148-155).—The authors' conclusions are as follows:

- Whatever the nature of this infection, it appears to be taken up from the intestine and carried to the liver by the portal vein, where it establishes itself, produces severe local damage, and later overwhelms the animal, either by extension into the blood stream or by the liberation of a soluble toxin.

- The original hypothesis that this is an atypical form of hemorrhagic septicemia has not been proved. The bacteriological and serological findings are rather against this theory. The clinical observations, anatomical changes, and the results of immunization and serum therapy seem to favor it."

The results of an experiment to note the effects of freezing on antihog cholera serum, H. C. H. KERNKAMP (*Cornell Vet.*, 8 (1918), No. 1, pp. 7-9).—Experiments are cited which would seem to prove that freezing under conditions that would be likely to occur in transit does not destroy the immunizing properties of antihog cholera serum or render it unfit for use.

Ticks affecting big game, F. BRADSHAW (*Ann. Rpt. Dept. Agr. Saskatchewan*, 11 (1916), pp. 232-235, figs. 2).—This reports upon the infestation of moose by the winter tick (*Dermacentor albipictus*), which resulted in the death of large numbers.

## RURAL ENGINEERING.

Irrigation by borders, or sloping checks, R. W. ALLEN (*U. S. Dept. Agr., Ser. Plant Indus., Work Umatilla Expt. Farm, 1915-16*, pp. 20-22).—"A series of preliminary investigations to determine the manner in which irrigation water moves in coarse sandy soil showed that it went down very quickly in all instances and spread out to a very limited extent. In furrow irrigation it was found that when water was applied by means of furrows 2 ft. apart it moved laterally through the soil so little that a portion of the soil to a depth of 6 ft. between the furrows remained dry, although the water was run for several hours in the furrows. Water was run through shallow furrows 2 ft. apart for six days in raw land without moistening the surface soil between them. It was then found that by flooding the land it could be uniformly moistened to depths which were determined by the quantity of water applied. Level checks could not be irrigated successfully, because the water disappeared so rapidly near the box that much waste occurred unless very small checks were used, or else the head of water must be very large and so cover the ground quickly. . . .

"An experiment was begun in 1916 to determine the influence of the length of the border on the amount of water required for successful irrigation with a given head. Three borders were made, 22 ft. wide, 100, 175, and 250 ft. long, and lettered a, b, c, respectively. The slope in each border is uniform and relatively similar in all of them, the total fall being 1.2 ft. in a, 1.8 ft. in b, and 1.9 ft. in c. Twenty-one irrigations were applied during the season, using a head of water that varied from 1 to 1.5 second-feet. . . . With this head of water and width of borders the 175-ft. border is irrigated as economically as the 100-ft. one. The 250-ft. border is not so economically irrigated, but no more water was applied to it than the soil was capable of holding. However, some waste probably resulted from deep percolation near the upper end. With a larger head of water it might be irrigated satisfactorily, but 250 ft. appears to be the maximum distance the water should be run under the best conditions found on these sandy soils. With a larger head of water, which should be used in general practice, the borders could be made much wider and the number correspondingly reduced."

Surface water supply of the South Atlantic and Eastern Gulf of Mexico Basins, 1915 (*U. S. Geol. Survey, Water-Supply Paper 402* (1916), pp. 51+XXI, pls. 2).—This report presents the results of measurements of flow made on streams in the South Atlantic and Eastern Gulf of Mexico Basins during 1915, together with the usual list of stream-gauging stations and publications.

Manual for water supply in villages, R. P. SPARKO (*Poso'ie d'ob'ed'eniya Vodoprovodshchikam*. Moscow: Glav. Uprav. Zemlestr. i Zemled., Otd. Zem. Uprav., 1915, 2. ed., pp. 205, pls. 8, figs. 30).—This book deals with ponds, dug wells, and springs as sources of water supply for villages and with machinery and apparatus for making such water available.

Bacteria in deep wells, F. W. TANNER and E. BASTON (*Univ. Ill. Bul.*, 14 (1916), No. 5, pp. 214-224, fig. 1; *abs. in Abs. Bact.*, 1 (1917), No. 2, pp. 184, 187; *Chem. Abs.*, 11 (1917), No. 11, p. 1706).—This is an abstract of a thesis in which studies of the number and character of the bacteria of waters from deep wells at different points in Illinois which had been in use for some time are reported. The wells varied in depth from 118 to 895 ft., with one 2,000 ft. deep.

While no definite conclusions were drawn, it was found that "these waters, which apparently are protected against contamination, contained bacteria commonly found in water. . . . The bacteria isolated occur in shallow well water and may not have come from a deep seated water, which is perhaps sterile."

With reference to *Bacillus coli* in ground waters, an investigation was made on a series of 19 tubular wells from 80 to 125 ft. deep in alluvial sand and gravel near a river. The results of analysis showed a decided difference in composition between the water of the river and that from the wells. Gas-forming bacteria were present in 10-cc. samples of the water in more than 90 per cent of the analyses made. The 1-cc. samples were positive in 43 per cent of the determinations, but in the 0.1-cc. samples there were only nine positive tests in 62. Gas formers isolated from six samples had characteristics like those of *B. coli*. Liquefying bacteria were present in a few samples and fluorescent colonies were identified in many. Some were identified as *B. fluorescens liquefaciens* and *B. fluorescens nontliquefaciens*.

In an experimental study to determine whether surface seepage enters wells 1 ton of fine salt was evenly divided among 11 privy vaults located near water supplies. No direct connection with pollution from surface sources was found.

Twenty-seven references to literature bearing on the subject are appended.

The factors which influence the longevity of *Bacillus coli* and *B. typhosus* in waters, M. E. HINDS (*Univ. Ill. Bul.*, 14 (1916), No. 5, pp. 225-233).—This is an abstract of a thesis, in which experiments are reported and the conclusion reached that "in pure, natural water and in redistilled water *B. coli* and *B. typhosus* die from starvation at a regular rate. The rate of death increases with the temperature and is similar to the rate of a chemical reaction, thus following the monomolecular law. The presence of mineral matter had no apparent effect on the organisms. The presence of oxygen under starvation conditions seems to be harmful to *B. coli* and beneficial to *B. typhosus*."

Twelve references to literature bearing on the subject are appended.

The viability of colon-aerogenes bacteria in water, L. A. ROGERS (*Abstr. Bact.*, 1 (1917), No. 1, pp. 56, 57).—Recent work, including some unpublished results of the author, show that fecal bacteria include, in addition to the true *Bacillus coli* which is characterized by a carbon dioxide ratio of approximately 1:1, a variety of *Bacterium aerogenes* which is distinguished from the type found commonly on grains by its uniform fermentation of adonite.

In water artificially infected with feces and held at 20° C. there was a gradual change in the ratio of these two types until at the end of nine months

the relative numbers were reversed and there were 39 *B. aerogenes* to 1 *B. coli*. In sewage held in running water there was a rapid decrease of colon bacteria which was more evident in the *B. coli* than in the *B. aerogenes*. At the beginning there were about three times as many *B. coli* as *B. aerogenes* but after seven days there were slightly more *aerogenes* than *coli*.

A comparison of a collection of cultures from water with the characteristics of similar collections from human feces and from grains showed a much greater similarity between the water and fecal cultures than between the water and grain cultures. This was especially true if those cultures evidently not of fecal origin were eliminated from the water cultures and those of evident fecal origin from the grain cultures.

Samples were taken at intervals from streams known to be badly contaminated and the number of each colon type determined. In each case the *aerogenes* type was greatly in excess above the source of pollution, but below the sewer there were more *B. coli* than *B. aerogenes*. In one stream there were no additional sources of contamination and the ratio of *B. aerogenes* to *B. coli* found above the sewer was regained in about 10 miles. In the second case there were other sources of contamination and the ratio of the two types remained at nearly 1:1 for the eight miles observed. In this stream it was found that while nearly all of the *aerogenes* cultures isolated above the sewer were not acid-formers, below the sewer the acid-formers predominated.

Observations on the types of organisms isolated from water after treatment with calcium hypochlorite, M. A. SWEETON (*Jour. Bact.*, 2 (1917), No. 4, pp. 353-359).—Experiments conducted at New York University with Croton River water which had been treated with calcium hypochlorite in the proportion of 1 part of chlorin to 2,000,000 parts of water showed that "the organisms found were apparently of the common saprophytic type usually found in air and water. No intestinal forms appeared to survive the treatment in the amount examined. It would appear, therefore, that available chlorin in the proportion of 1 part to 2,000,000 is sufficient to purify surface water obtained under conditions similar to that of the Croton supply."

The English incubation test for the putrescibility of sewage and sewage effluents, F. W. MOHLMAN (*Univ. Ill. Bul.*, 14 (1916), No. 3, pp. 315-324).—This is an abstract of a thesis in which experimental work consisting of incubation tests at 20° C. with various dilutions of sewage and distilled water are reported, the purpose being to determine the value of the procedure rep-

resented and modified by the so-called Phelps formula  $\log \frac{O'}{O} = KCt$ . In this  $O$  = the final amount of oxygen present in the water in unit volume,  $O'$  = the concentration of the sewage in percentage by volume,  $t$  = the time in hours allowed for the reaction to proceed,  $O'$  = initial amount of oxygen present, and  $K$  = a constant determined by the character of the organic matter and in turn defining the oxidizability of that organic matter.

Most of the results indicate that the oxygen consumption is nearly complete in ten days. The variability in the amount of oxygen absorbed per liter of sewage in different dilutions is excessive. The amount of oxygen absorbed depends entirely upon the amount added and is always higher in higher dilutions. The values of  $K$  seem to be more concordant, although they are generally higher in higher dilutions. The excessive consumption of oxygen in higher dilutions may be caused by the actual loss of oxygen gas, or may be caused by the more vigorous oxidation. Whatever may be the cause, the fact remains that the method did not give consistent results in varying dilutions. If the same

dilution could always be used, the results would be of some comparative value. The biological oxygen consumption of any sewage as determined by this method, however, could not be balanced against the oxygen in a stream, since almost any value could be obtained for the sewage, depending upon the dilution used. . . .

"As a practical test, the English method of determining biological oxygen consumption is subject to very grave errors and is only applicable under limited conditions. These conditions are that the same dilution must always be used if results are to be at all comparable and that incubation must extend over at least three days at 20°. Oxygen demand for longer periods may then be calculated by Phelps's formula."

Bacteriological study of sewage purification by aeration, R. RUSSELL and E. BARTOW (*Univ. Ill. Bul.*, 14 (1916), No. 5, pp. 348-358).—Investigations of the bacteriology of sewage purification by aeration brought out the following features:

"There is a large and consistent reduction of the total number of bacteria in the sewage. The actual stabilization process is due to a typical aerobic bacterial flora which gains almost complete ascendancy. The other inhabitants are largely incidental. The actual nitrification is accomplished by two typical known nitrifiers, *nitrosomonas* and *nitrobacter*."

Purification of sewage by aeration in the presence of activated sludge, E. BARTOW and F. W. MOHLMAN (*Univ. Ill. Bul.*, 14 (1916), No. 5, pp. 325-335, figs. 5).—Some further experiments on this process are described (E. S. R., 34, p. 501).

Handbook of clearing and grubbing: Methods and cost, H. P. GILBERT (*New York: Clark Book Co., Inc.*, 1917, pp. [VI]+241, figs. 67).—In this handbook are compiled a large amount of data on methods and costs of clearing land, much of which consists of the results of the author's broad experience along these lines. The first two chapters deal with factors affecting cost estimating and appraising and with specifications relating to methods of land clearing for roads, reservoirs, and railways and for general purposes. Other chapters deal in detail with land clearing practice in general; grubbing by hand; burning and charpitting; blasting; hand, horse, and power stump pullers; and heavy plows. A list of manufacturers of supplies and equipment for use in clearing and grubbing is included.

Tests of a large-sized reinforced-concrete slab subjected to eccentric concentrated loads, A. T. GOLDBECK and H. S. FAIRBANK (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 10, pp. 505-520, figs. 11).—In continuation of work previously noted (E. S. R., 33, p. 487; 35, p. 290; 36, p. 788; 38, p. 290) tests on the effect of eccentricity of loading of a reinforced concrete slab 22 by 16 ft., 14 in. thick with 13 in. effective thickness, are reported. The concrete was a 1:2:4 mixture, and the slab which was built in place was supported by concrete abutments.

It was found that "to provide against the frequently realized condition of a heavy concentrated load applied near the parapet . . . the resisting moment required in the portion of a bridge slab near the outer edges is greater than that which is necessary in the central portion. Further than this, if the relation indicated above be verified and shown to include other span lengths, it would seem that in designing a slab the necessary allowance for the concentrated load near the outer edge can be made very simple in the following manner: (1) Use the formulas for narrow rectangular beams, substituting for the breadth (b) the value obtained from the table for central concentrated loads [E. S. R., 35, p. 291]; (2) determine the loss in effective width due to

the assumed eccentricity of the load; and (3) supply the deficiency by designing the curb of the parapet to provide a resisting moment equal to that of a slab of width equal to the loss in effective width due to eccentricity, making allowance for the greater stiffness of the section under the parapet. Thus, suppose a slab of 16-ft. span and 20-ft. width is to be designed to carry a concentrated load of 20,000 lbs. applied at a point 4 ft. from one edge, then

$$\frac{\text{Total width } 20}{\text{Span } 16} = 1.25$$

from the table for central concentrated loading, the effective width  $= 0.69 \times 16$  ft.  $= 11.04$  ft. Consider the load of 20,000 lbs. to be carried by a width of 11.04 ft. use the ordinary formulas for rectangular-beam design and determine the effective depth of the slab and the area of steel required. Now, by the relation indicated above, determine the effective width with the load in the critical position 4 ft. from one edge, then

$$(be) = \frac{11.04}{2} + 4 = 5.52 + 4 = 9.52 \text{ ft.}$$

the difference between the values of  $bc$  and  $be$  is  $11.04 - 9.52 = 1.52$  ft. Therefore the curb of the parapet should be so designed that it will have a resisting moment equal to that of a width of 1.52 ft. of the slab, making allowance for the greater stiffness of the parapet section. In constructing slabs designed in this manner . . . the curb of the parapet must be added before the concrete of the slab has taken initial set."

How the surface of a road affects tractive effort (*Engin. News-Rec.*, 79 (1917), No. 8, pp. 367-369, figs. 5).—Traction tests under California conditions are reported with a standard farm wagon equipped with steel axles of equal length and 38- and 46-in. wheels, all wheels having 4-in. tires. The gross load was 3 tons, and the speed was kept close to 2.4 miles per hour. Typical results are summarized in the following table:

*Tractive resistance for various road surfaces.*

Kind of road.	Condition of road.	Tractive resistance.	
		Total.	Per ton.
		<i>Lbs.</i>	<i>Lbs.</i>
Concrete (unsurfaced) . . . . .	Smooth, excellent . . . . .	83.0	27.6
Concrete (unsurfaced) (load apparently accelerated when test was started) . . . . .	do. . . . .	90.0	30.0
Concrete (1-inch surface, asphaltic oil and screenings) . . . . .	do. . . . .	147.6	49.2
Macadam (water-bound) . . . . .	do. . . . .	155.0	51.6
Tar on concrete . . . . .	do. . . . .	193.0	64.3
Gravel . . . . .	do. . . . .	205.5	68.5
Macadam (drawn with motor truck at 2½ miles per hour) . . . . .	Compact, good condition . . . . .	225.0	75.0
do. (drawn with motor truck at 5 miles per hour) . . . . .	Good, new . . . . .	234.5	78.2
do. (drawn with motor truck at 5 miles per hour) . . . . .	do. . . . .	244.0	81.3
Tar on plank . . . . .	Packed, in good condition . . . . .	247.0	82.3
Gravel on plank . . . . .	Good condition, soft, wagon left marks . . . . .	265.0	88.3
Earth road . . . . .	Firm, 1½ in. fine loose dust . . . . .	276.0	92.0
Gravel on plank . . . . .	Good condition, but soft . . . . .	278.0	92.6
Earth road . . . . .	Dust ½ to 2 in . . . . .	286.0	95.3
Earth . . . . .	Mud, stiff, firm underneath . . . . .	684.0	228.0
Gravel . . . . .	Loose, not packed . . . . .	789.0	263.0

The resistance encountered on oiled surfaces was considerably more than on concrete. . . . The base supporting oiled surfaces affected the amount of tractive effort required. For example, tests . . . in which a concrete base was in-

volved showed less resistance than tests . . . in which the surface was on plank."

The tests were made under the supervision of the agricultural engineering division of the University of California in cooperation with the California Automobile Association.

Charts for the use of road-oil inspectors, E. E. GLASS (*West. Engin.*, 1 (1917), No. 9, pp. 350, 351, figs. 5).—These five charts give data on volume of cylinders, contents of partly filled horizontal tanks, spread of  $\frac{1}{2}$  and  $\frac{3}{4}$  gal. per square yard, and thermal corrections for road oil.

A kerosene carbureter, T. C. MENGES (*Gas Engine*, 19 (1917), No. 7, pp. 316-318, fig. 1).—This article describes a kerosene carbureter for a throttle-governed engine and gives a mathematical discussion of the design for a particular size of engine. Experiments are also described to determine the proper location of the kerosene nozzle in the inlet pipe.

It is concluded that in order to operate successfully on kerosene it is necessary to heat up the mixture and keep it hot until it is exploded. Water must be admitted to the mixture in proportion to the work being done, and the engine must be throttle governed. The inlet orifice should be as small as possible in order to break up the liquid kerosene, and means must be provided for starting the engine on gasoline and gradually switching from gasoline to kerosene.

A laboratory manual in farm machinery, F. A. WIER (*New York: John Wiley & Sons, Inc.*, 1917, pp. XII+162, figs. 42).—This manual is intended as a laboratory guide which will not be affected to an appreciable extent by ordinary changes in farm machinery construction. It is considered suitable for university students, and is arranged with the idea in mind that the questions asked will lead students to draw their own conclusions as to which machines are best adapted to the various agricultural conditions.

Part 1, Farm Field Machinery, contains chapters on machinery used in preparing the soil, seeding, cultivating, grain and corn harvesting, hay harvesting, pumping, and miscellaneous work. Part 2, Power Farming Machinery, contains chapters on power drawn and belt driven machinery. Part 3, Farm Mechanics, contains chapters on rope, belts, babbitting, soldering, and pipe cutting. The largest section on a single subject is that devoted to rope, which includes discussions of methods of preventing the untwisting of rope ends, loops at the rope ends and between the ends, knots for tying ropes together, hitches, halters, and block and tackle.

Instructions to students and exercises are also included.

Markets for agricultural implements and machinery in Chile and Peru. F. H. von MUTZ (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser.*, No. 142 (1917), pp. 48).—This report deals with the markets for agricultural implements and machinery in Chile and Peru. It is stated that the west coast markets are distinctly less promising than those of the farming countries in the eastern part of South America.

Heat losses through buildings and building materials, R. S. HAWLEY (*West. Engin.*, 8 (1917), No. 9, p. 344, fig. 1).—Graphic data are given on heat loss through building materials which may be of value in designing farm buildings and their heating systems.

Fire prevention and fire fighting on the farm, H. R. TOLLEY and A. P. YERKES (*U. S. Dept. Agr., Farmers' Bul.* 904 (1918), pp. 16, figs. 2).—The preventable nature of most farm fires is pointed out, and means of fire prevention and fire fighting are described.

## RURAL ECONOMICS.

**Farm management and farm profits on irrigated land in the Provo area (Utah Lake Valley), L. G. CONNOR (U. S. Dept. Agr. Bul. 582 (1918), pp. 40, pls. 4).**—This report is based on a study made in 1914 of 104 farms in the Provo area, Utah, in continuation of work previously noted (E. S. R., 31, p. 299). The author comes to the following conclusions:

"The size of the farm business, type of farming followed, and the diversity of income, each has an important bearing on profits. As regards size, the labor income from 28 small fruit farms and general farms [16.48 acres] averaged \$300; for 29 large fruit and general farms [77.2 acres], \$598; and for 20 live stock farms [100.65 acres], \$1,394. As regards type of farming, the labor income of 16 small fruit farms averaged \$302; of 18 small general farms, \$383; of 17 large fruit farms, \$611; and of 24 large general farms, \$646. Eighteen dairy farmers made an average labor income of \$1,427, and three small poultry farms averaged \$483.

"The greatest need of the small farmers in this district is more land to work. Failing this, outside labor is a necessity if a good living is to be secured. . . .

"In general, so far as practicable, the farmer taking more land should do so by rent or lease, rather than purchase subject to a mortgage, as he can usually secure the use of the land for little more than half what must be paid on a mortgage. The money saved can be used for subsequent purchase. This, of course, does not apply to the man with cash in hand for immediate purchase.

"Some operators live in town and travel many miles a day to and from the farms. From a farm-management viewpoint this is an inefficient system.

"With land values and labor cost so high, and the marketing situation so complicated, farmers in this area should make every effort to keep at the maximum that part of the family living which is secured directly from the farm. The garden should be one of the regular enterprises and should be given adequate care.

"A further increase in the number of very small farms in this region would seem to be unwise. The operators of such units have not enough land to keep them busy at profitable work. About 30 acres seem to be the smallest size for efficient management without much reliance on live stock. Forty to fifty, preferably about 50 acres, seem to be the smallest unit for efficient management where live stock enterprises are given a prominent place by the typical farmer. This is especially true of dairying. . . .

"In general, owing to market conditions, the proper place for orchard and truck products in this region is on general farms where they are used as fillers in the business as a whole. Certainly fruit should be produced only on farms where the orchard enterprises are supplemented in a substantial way by more extensive activities. The general farms which grow truck and fruit as secondary enterprises approximate the ideal cropping combination for this region."

**The organization of the farm business for profit, G. N. DAGGER and J. I. FALCONER (Agr. Col. Ext. Bul. [Ohio State Univ.], 13 (1917-18), No. 3, pp. 29, pls. 17).**—This bulletin discusses the factors to be considered in choosing the type of farming to be followed and in organizing farm business for profit. The text is illustrated with data obtained from Ohio farms.

**International yearbook of agricultural legislation (Inst. Internat. Agr. [Rome]. Ann. Internat. Lég. Agr., 6 (1916), pp. LXXXI+1458).**—By adding new laws, this volume continues the information previously noted (E. S. R., 30, p. 303).



**Laws of Maine relating to agriculture** (*Bul. [Maine] Dept. Agr., 16 (1917), No. 4, pp. 112*).—This bulletin continues information previously noted (*E. S. R., 22, p. 595*) by adding information of later date.

**The laws of South Dakota establishing a system of rural credits** (*Rural Credit Bd. [S. Dak.] Circ. 1 (1917), pp. 12*).—This pamphlet contains the text of the act establishing a system of rural credits, approved February 26, 1917.

**Cheaper money for Saskatchewan farmers** (*Saskatchewan Dept. Agr. Bul. 47 (1917), pp. 7*).—This pamphlet contains a brief statement regarding the Saskatchewan farm loan act, and points out the nature of the loans, methods of making payments, and purchase of the farm loan bonds.

**Live stock on credit terms to Saskatchewan farmers, and the cooperative marketing of live stock and live stock products, butter, wool, poultry, etc.** (*Saskatchewan Dept. Agr. Bul. 45 (1917), pp. 20*).—These pages describe the method of distributing live stock under the provisions of the Saskatchewan live stock purchasing and sales act, and indicate the various steps in distribution and finance, selling, organizing, and establishing creameries, and the establishment of cooperative live stock marketing associations, wool associations, and cooperative poultry-killing and marketing associations.

**Farmers' market bulletin** (*North Carolina Sta., Farmers' Market Bul. 4 (1917), Nos. 17-19, pp. 8 each*).—These bulletins contain the usual lists of growers having produce and live stock for sale, indicating quality, shipping date, and variety and breed.

**Suggestions to purchasers of farm lands in New York**, E. O. FIPPIN (*N. Y. State Col. Agr., Cornell Ext. Bul. 23 (1917), pp. 58-78, figs. 22*).—This publication describes the general characteristics of farm land in New York State, indicates some reasons for the wide range in prices of land, and points out some of the facts relating to agricultural development and social conditions.

**Economics of agricultural production in South Africa**, R. A. LEHVEIT (*So. African Jour. Indus., 1 (1917), Nos. 1, pp. 35-43; 2, pp. 105-112*).—In these pages are discussed the present system of agricultural production in South Africa and the possibility of introducing sugar plantations.

**Condition and movement of agricultural laborers and rural population in France in 1913-14**, L. DUKE DE BERNONVILLE (*Statist. Gén. France, 6 (1917), No. 3, pp. 295-330, figs. 2*).—These pages discuss the extent of the movement of people from one part of the country to another, the influence of the number of births upon the increase and decrease in population, the proportion of those on farms who are owners, operators, and laborers, and the extent of the movement of people from the rural districts and of the decrease in the number of families. The question of rural health is also touched upon.

**The world's food** (*Ann. Amer. Acad. Polit. and Soc. Sci., 74 (1917), No. 161, pp. 81-301, figs. 20*).—This number contains a series of papers relating to the world's food, covering such topics as the food situation in various countries, its utilization and conservation, plans for production and marketing for the coming year, and price control.

**The corn trade during the war**, C. KAINS-JACKSON (*Jour. Roy. Agr. Soc. England, 3. ser., 76 (1915), pp. 49-73*).—These pages give statistical data showing the imports into the United Kingdom of grain during the years 1913 and 1914-15, indicating the source, amount, and price.

**The corn and meat trades since the war** (*Jour. Roy. Agr. Soc. England, 3. ser., 77 (1915), pp. 62-78*).—W. Weddel & Co., Ltd., give data which continue those noted above by adding statistics for the year 1915-16, and also information regarding the meat trade during the war.

Prices and supplies of corn, live stock, and other agricultural produce in England and Wales (*Bd. Agr. and Fisheries* [London], *Agr. Statis.* 51 (1916), *Vol. 3*, pp. 62-93).—This bulletin continues data previously noted (*E. S. R.*, 36, p. 383), by adding statistics for 1916.

Agricultural statistics of Chile (*Statis. Abs. Chile* [1916], pp. 78-93).—This report contains data showing by provinces for 1916 the number of farms, area classified as to irrigation or nonirrigation, and the area under the principal crops and their yields, with comparative data for similar items for previous years.

Agricultural statistics of Uganda Protectorate (*Ann. Rpt. Dept. Agr. Uganda*, 1917, pp. 42-45).—These pages contain data showing by provinces and districts for 1916-17 the number of live stock by classes and the extent of crops possessed by the natives and by foreigners.

### AGRICULTURAL EDUCATION. -

Departmental organization in agricultural teaching, F. H. BLODGETT (*School and Soc.*, 6 (1917), No. 154, pp. 668-672).—The author calls attention to the lack of correlation between the scientific and practical fields of college subjects, especially noticeable in biology and agriculture. He discusses from the point of view of organization of the teaching force, rather than the relation of the topics taught, the grouping of work into divisions of closely related topics, to include both pure or theoretical and applied phases of the several subjects. In his opinion, this should effect a closer coordination of work and procedure than if the divisions are based only on the final utility of the work.

The scope and methods of instruction in rural sociology, J. M. GILLETTE (*Publ. Amer. Sociol. Soc.*, 11 (1916), pp. 163-180).—The author defines rural sociology and discusses the scope of instruction in this subject, including as the more important centers of interest, rural responses to physical interests, population, production in the economic sense, communication, health, neighborhood institutions and organizations, pathological social conditions of country life, the psychology of the rural social mind, semirural and town-country communities and their problems, the relation of country to city, and investigations and surveys. He also sketches the more important methods of instruction found profitable in this field, viz, text and lecture work, the study of rural surveys, and investigations.

The value of a technical education to a forest supervisor (*Yale Forest School News*, 5 (1917), No. 4, pp. 52-56).—This is a series of articles edited from letters received in general correspondence with forest supervisors with reference to their opinion as to the value of their forest school training for the work they are now doing.

There seems to be a general opinion that, inasmuch as at the present time the forest supervisor's duties lie more along the lines of a business manager than a technical forester, so far as direct utilization goes only a little of the forest school training has applied specifically, a little mensuration, a little applied silviculture, a good deal of surveying and engineering—about what could be acquired in a six months' selected course. It is pointed out, however, that the great value in the forest school training is the establishment of a background, the fixing of ideals to work toward. While there are many very valuable men in the service who have never had a forest school training, the demands of the future will be such as to make such training an extremely valuable asset. The forest supervisor should have clearly in mind the broad and basic principles upon which to build a régime and a forest wisely and con-

servatively used. A technical forestry training also gives the supervisor a broader outlook, enabling him better to realize the possibilities of his forest and resulting in less danger of having the forest looked upon as something reserved rather than something to be properly used. There is also the pleasure derived from the knowledge of plant and animal life and of silvicultural subjects.

**Elementary science**, J. G. COULTER (*New York: Charles Scribner's Sons 1917, pp. VIII+239, figs. 107*).—This text includes the following chapters relating to agriculture: Water and agriculture, origin of soil, kinds of soil, fertility and soil life—bacteria, food—the nutritive cycle, plant life, the story of seeds, plant groups, relations between plants and their surroundings, and insects.

The author has adopted the colloquial method of presentation, accompanied by more or less repetition, since it proved to be the most effective as tested by many trials with classes.

**Productive agriculture**, J. H. GEHRS (*New York: The Macmillan Co., 1917, pp. XIV+436, figs. 245*).—The author's object in writing this book is to standardize seventh and eighth grade agriculture in the rural schools. It is intended to meet the demands of the courses of study of the north central States and treats of the origin, history, importance, distribution, varieties, breeds, conditions, cost, and methods of production; how to increase production; harvesting, and uses of farm crops and animals, including poultry; soils and their improvement; horticulture, including plant propagation, vegetable gardening, fruit growing, and the farmer's wood lot; and farm management, including the choosing and planning of a farm, farm bookkeeping, farm labor, and the relation of animal husbandry to permanent agriculture. The chapters, each of which is followed by laboratory exercises, are arranged to conform as closely as possible to the farmer's seasonal occupations. A list of apparatus and equipment, with approximate cost, and a brief bibliography are included.

**Courses in secondary agriculture for southern schools (third and fourth years)**, H. P. BARBOWS (*U. S. Dept. Agr. Bul. 592 (1917), pp. 40*).—Continuing previous work (*E. S. R., 37, p. 395*), this bulletin outlines (1) one unit of instruction in horticulture, including plant propagation, fruit growing, home floriculture, home-ground improvement, and vegetable gardening, for the third year; and (2) one-half unit of instruction in rural engineering, including farm machinery, farm structures, farm sanitation, agricultural surveying, farm drainage, irrigation, terracing, roads, and rope work, and one-half unit in rural economics and farm management, for the fourth year. The distribution of time and credits, elective courses, practicums, projects, illustrative material, texts and references, and equipment are suggested.

**The farmer and his friends**, EVA M. TAPPAN (*New York: Houghton Mifflin Co., 1916, pp. VI+106, figs. 15*).—This book, intended as a reader for the grammar grades, compares the old agriculture and the new, and contains information concerning the help given by the Federal and State Governments in teaching the farmer, the production of sugar, the growing, harvesting, storing, and uses of potatoes, apples, wheat, rice, oranges, raisins, flax, and cotton, bees and their work, raising chickens, the care and shearing of sheep, the care of cows, the handling of milk and the production of butter and cheese, and a logging camp.

**Judging sheep as a subject of instruction in secondary schools**, H. P. BARBOWS (*U. S. Dept. Agr. Bul. 593 (1917), pp. 30, figs. 23*).—This bulletin, intended for teachers, includes (1) an outline of classroom instruction in judging sheep, comprising the use of illustrative material, a study of types and breeds

market classes and grades, the relation of type to efficiency, and the score card; (2) a description of mutton sheep; and (3) suggestions on practice judging.

A simple course in home economics for rural schools, MARY E. GEARING, JAMES P. RICH, and M. MINERVA LAWRENCE (*Bul. Univ. Tex.*, No. 49 (1916), pp. VIII+9-162, figs. 5).—These lessons have been specially prepared to meet the needs of the small schools in which a special teacher and expensive equipment are not as yet possible. The course is intended to give pupils an intelligent understanding of the composition of foods, their value and uses in the body, and the proper combinations and amounts necessary for a well-balanced diet, and to enable them to prepare and serve wholesome and attractive dishes at the minimum expenditure of time, labor, and money. Each lesson consists of subject matter, references to literature, a plan for teaching and correlating with other school subjects, and recipes. A plan for the practical application of the work to solve the question of the noon lunch is suggested. Two lists of cooking equipment for the 1-room rural school, costing, respectively, \$3.50 and \$13.50, are included.

#### • MISCELLANEOUS.

Biennial Report of Connecticut Storrs Station, 1914-15 (*Connecticut Storrs Sta. Rpt. 1914-15*, pp. IX+302+253-274, figs. 116).—This contains the organization list, a financial statement for the fiscal years ended June 30, 1914, and June 30, 1915, a report of the director, and reprints of Bulletins 80-83, previously issued. Meteorological data for 1914 and 1915, noted on page 416, are appended.

Thirtieth Annual Report of Vermont Station, 1917 (*Vermont Sta. Bul.* 208 (1917), pp. 16).—This contains the organization list, a brief announcement concerning the station, a financial statement for the fiscal year ended June 30, 1917, and a report of the director on the publications and work of the station.

The work of the Umatilla Reclamation Project Experiment Farm in 1915 and 1916, R. W. ALLEN (*U. S. Dept. Agr., Bur. Plant Indus., Work Umatilla Rpt. Farm, 1915-16*, pp. 39, figs. 3).—This report includes a summary of meteorological observations from 1912 to 1916, a review of climatic and agricultural conditions on the project, and a report of the work on the experimental farm during 1915 and 1916. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta. West. Wash. Sta., Mo. Bul.*, 5 (1917), No. 9, pp. 125-140, fig. 1).—This contains brief articles on the following subjects: The Activities of the Office of Farm Markets, by A. Hobson; Redwater or Bloody Urine in Cattle, by J. W. Kalkus (see p. 436); Fertilizer Saving by Improved Stable Methods, by H. L. Blanchard; Increasing Crop Production by Drainage, by E. B. Stookey; Maintenance of Egg Production During Winter, by Mr. and Mrs. G. R. Shoup; The Adaptability of the Tractor to the Smaller Farms, by J. P. Fairbanks; Getting Rid of Rats; and Farmers' Winter School.

Index to General Bulletins 1 to 25, H. B. CLEES (*Washington Sta., Index Gen. Buls. 1-25* (1917), pp. 12).—This is a combined subject and author index.

Index (*Hawaiian Sugar Planters' Sta., Div. Ent. [Pamphlet]*, pp. 8).—An index to Volume 3, comprising Bulletins 6-13.

Two methods of orientation of small objects in paraffin, J. A. NELSON (*Science, n. ser.*, 46 (1917), No. 1190, p. 337).

## NOTES.

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**Arkansas University.**—E. B. Mathew, head of the department of agricultural education in the Fort Hays (Kans.) Normal School, has been appointed head of the department of agricultural education.

**Kansas College and Station.**—N. L. Harris, superintendent of the poultry farm, has resigned to become poultry specialist in the extension division of the University of Arizona and has been succeeded by Harold H. Amos. W. S. Lashaw, assistant in soil analysis, has been appointed assistant professor of chemistry and will take charge of certain lines of analytical work in the station. R. W. Titus, instructor in chemistry, has been transferred to the station as assistant chemist and has been succeeded by H. E. Fowler. C. A. A. Litt, in charge of analytical work on foods and dairy products, has resigned to engage in commercial work in Baltimore, Md.

**Massachusetts College.**—Alfred G. Lunn, instructor in poultry husbandry, resigned March 1 to become head of the newly established poultry department at the University of British Columbia.

**Minnesota University and Station.**—Recent appointments include I. D. Charlton, professor of agricultural engineering at the Washington College, as professor of farm engineering and chief of the newly established division of farm engineering; R. O. Westley as assistant professor of agronomy; and A. M. Christensen as instructor in farm crops at Crookston. W. W. Cumberland has been appointed chief of the division of research in agricultural economics and agricultural economist of the station, effective August 1.

F. L. Kennard, agronomist, and O. M. Kiser, instructor in farm crops at Crookston, have resigned. Leave of absence has been granted to E. C. Stalman, associate plant pathologist, to direct work for the control of cereal rusts in the upper Mississippi Valley; W. D. Vallean, research assistant in fruit breeding; and D. O. Spriestersbach, research assistant in agricultural biochemistry.

**Missouri University and Station.**—An apportionment of State funds for the calendar year 1918 has been made as follows: Agricultural laboratories, \$3,000; short winter course, \$11,000; agricultural engineering, \$1,000; animal husbandry, \$7,500; dairy husbandry, \$2,500; entomology, \$500; farm management, \$1,000; horticulture, \$1,500; poultry husbandry, \$750; rent on farm lands, \$1,000; pure bred live stock, \$500; repairs and improvements on barns, \$500; for the station, \$15,000; soils department, \$500; soil survey, \$6,500; soil experiment fields, \$5,325; farm crops experiment fields, \$4,675; agricultural extension, \$32,500; and to promote the growing of improved corn, \$1,500.

The second term of the 1917-18 session of the short winter course in agriculture closed March 1. In spite of war conditions the enrollment was not seriously curtailed, the total of 182 students for the two terms being about 10 per cent less than for the previous year. An unusual amount of interest was manifested in the course, and the enrollment for the next session is expected to be considerably larger.

P. H. Ross, county agent leader for the State, has been appointed assistant director of the agricultural extension service. George W. Hervey, assistant in poultry husbandry, has received leave of absence for the period of the war, his

work being taken up by E. L. Dakan. T. J. Talbert, extension entomologist, has also been given leave of absence during the war to serve as executive secretary for the Federal Food Administrator of Missouri. D. A. Spencer, assistant professor of animal husbandry and assistant animal husbandman at the college and station, has been appointed to take up special work in sheep husbandry in the agricultural extension service.

**Nebraska University and Station.**—Dr. L. Van Es, dean of the veterinary division of the North Dakota College and acting director of that station at the present time, has been appointed in charge of the department of animal pathology beginning July 1. Laboratories for the department are shortly to be erected at a cost of from \$80,000 to \$100,000, and a special State appropriation is also available for research in animal diseases.

E. E. Brackett, associate professor of agricultural engineering, and I. D. Wood, extension assistant professor of agricultural engineering, have been granted leave of absence for war service as first and second lieutenant, respectively, in the aviation section. Howard N. Colman resigned as instructor in dairy husbandry, March 1, to become superintendent of the advanced registry work at the Washington College, and has been succeeded by M. N. Lawritson.

**Cornell University.**—Miss Martha Van Rensselaer has received leave of absence from the department of home economics to become director of the division of home economics of the U. S. Food Administration, beginning early in March.

Cecil C. Thomas has resigned as instructor in botany to accept a position with the plant disinfection work of the Federal Horticultural Board.

**Ohio State University.**—S. M. Salisbury has resigned as assistant professor of animal husbandry to become agricultural agent for Medina County.

**Oregon College and Station.**—John Martin, superintendent of the Belle Fourche substation of the Bureau of Plant Industry in South Dakota, has been appointed superintendent of the Harney substation, vice L. R. Breithaupt, resigned to engage in farming. J. E. Cooter has resigned as instructor in soils to become instructor in agriculture in a Portland high school and supervisor of school gardens in that city.

**Porto Rico Insular Station.**—Because of the shortage of funds in the Insular treasury, the act recently passed for the reorganization of the station will not go into effect before July 1. This act establishes a number of new positions in the divisions of plant pathology, chemistry, entomology, and horticulture, as well as providing for 2 agricultural inspectors and 10 subinspectors.

W. V. Tower resigned as director in December, 1917, and has become entomologist in the Federal Station at Mayaguez. He has been succeeded by E. Colón. Leave of absence has been given R. T. Cotton, entomologist, and he is attending an officers' training camp at San Juan. R. C. Rose, assistant pathologist, is on leave of absence as a lieutenant in the Reserve Officers' Corps. Luis David, assistant entomologist, has resigned to enter commercial work.

**Clemson College.**—Dr. Wilson Gee, professor of biology at Emory University, has been appointed assistant director of extension work.

**Utah Station.**—J. W. Jones of the Office of Cereal Investigations of the U. S. Department of Agriculture, who has been superintendent of the Nephi substation for several years, has been transferred to the rice experimental farm at Biggs, Cal. The vacancy will be filled by Aaron F. Bracken, formerly assistant agronomist of the station and recently a county agent in the State. Irving J. Jensen has been appointed assistant agronomist, vice N. I. Butt resigned to engage in farming.

**Vermont University and Station.**—George F. E. Story, head of the department of animal and dairy husbandry, has resigned to become director of the Worcester County (Mass.) Farm Bureau.

**Wyoming University.**—J. D. McVean, who has been on pig club work with the Bureau of Animal Industry, U. S. Department of Agriculture, has accepted a position as extension worker in animal husbandry beginning April 1.

**Experiment Station Record.**—E. H. Nollan, specialist in agricultural, biological, and physiological chemistry, has resigned to engage in commercial research on dyes. He has been succeeded by Miss Sybil L. Smith, head of the department of chemistry in Milwaukee-Dowder College.

**Cuban Experiment Station.**—Dr. Mario Calvino, formerly chief of the department of horticulture in the Central Experiment Station of Mexico, has been appointed director.

**Farm School and Experimental Work in Uruguay.**—A decree of October 18, 1917, of the Uruguayan Government, provides for a school for farm foremen to be opened at the National Nursery and Poultry Farm maintained by the Government at Toledo. A maximum of 20 pupils over 16 years of age, who must come from poor families and know how to read and write, will be admitted. The 2-year course which will be offered will include tree nursery and orchard work, general farming, pastures, vineyards and wine making, poultry raising, apiculture, and hog raising.

Experimental studies are to be initiated at once with soil mixtures for potting and transplanting, sizes of pots and packing, the economic and feeding value of native forage plants, the extension of plantations of yerba mate (Paraguayan tea), and the manufacture of starch and alcohol. The commission in charge of the nursery is authorized to apply \$2,585 from the receipts of the establishment to the installation and maintenance of the school during the period from November, 1917, to June, 1918.

**New Journals.**—*The Scottish Journal of Agriculture* is being issued quarterly by the Board of Agriculture of Scotland. It is patterned closely after *The Journal of the Board of Agriculture* of England, consisting of general articles, a review of recent periodical literature, official notices, statistics, etc. The initial number contains a description of the important Corn Production Act of Great Britain. This act took effect in Ireland, August 21, 1917, and will become effective in England, Scotland, and Wales a year later, and continues in force until 1922. It supplements the Defense of the Realm Act, and provides for minimum prices on wheat and oats through a system of subsidies, fixes minimum wages for farm laborers, restricts the raising of agricultural rents, and confers sweeping powers upon the authorities to enforce proper cultivation of lands to insure good husbandry and maximum food production.

*The Voorhees Farmer* is being published at Rutgers College by the E. R. Voorhees Agricultural Society, as a medium for reaching the progressive farmers in the State in a practical way. The initial number contains several articles by the members of the college and station staff, including one by Director Lipman, entitled *The Service Rendered to the Farmers of New Jersey by Their Agricultural Experiment Station and College*.

*The South African Journal of Industries* is being issued by the Department of Industries as an official organ for the advancement of the industrial interests of the Union of South Africa. The initial number contains articles on *The Economics of Agricultural Production in South Africa*, *The Increase of Food Production*, *South African Buchu*, etc.

The International Institute of Agriculture has established a publication supplementary to the *Monthly Bulletin of Statistics* and known as *Documentary Leaflets*. This will embody scattered data relative to yields, trade, stock prices, freight rates, etc., especially of such crops as rubber, cocoa, tea, and jute.

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